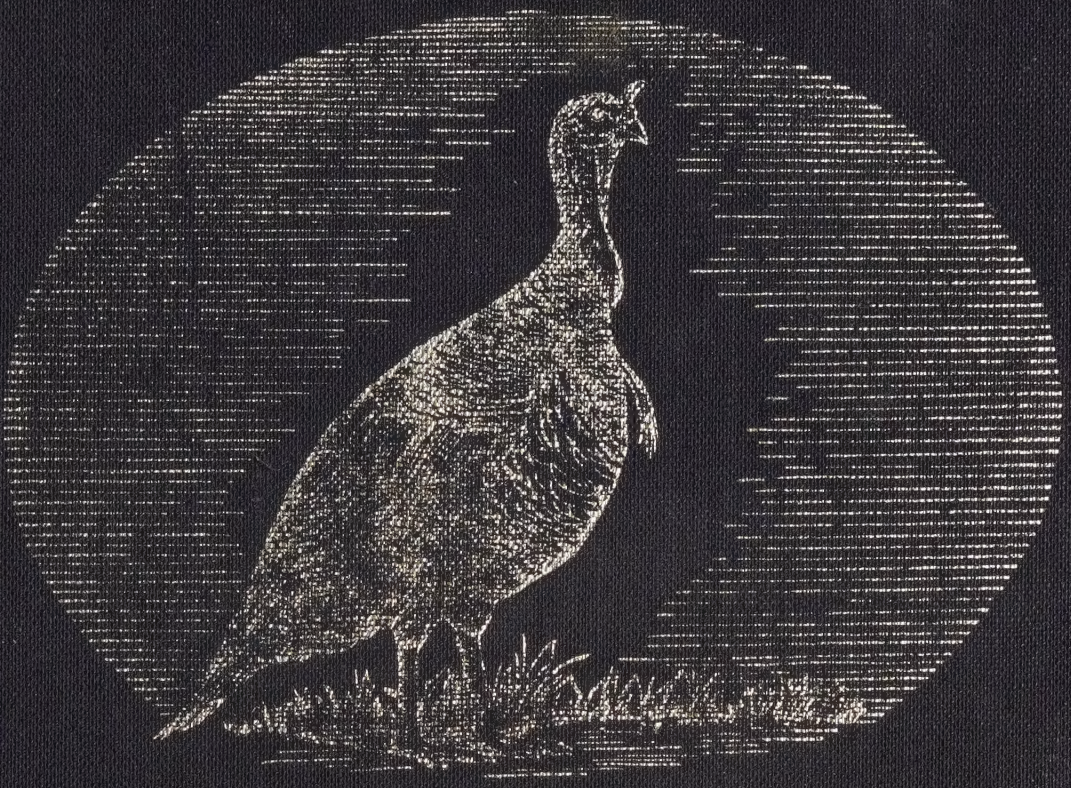

Raising Turkeys

DUCKS · GEESE · GAME BIRDS

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by Morley A. Jull

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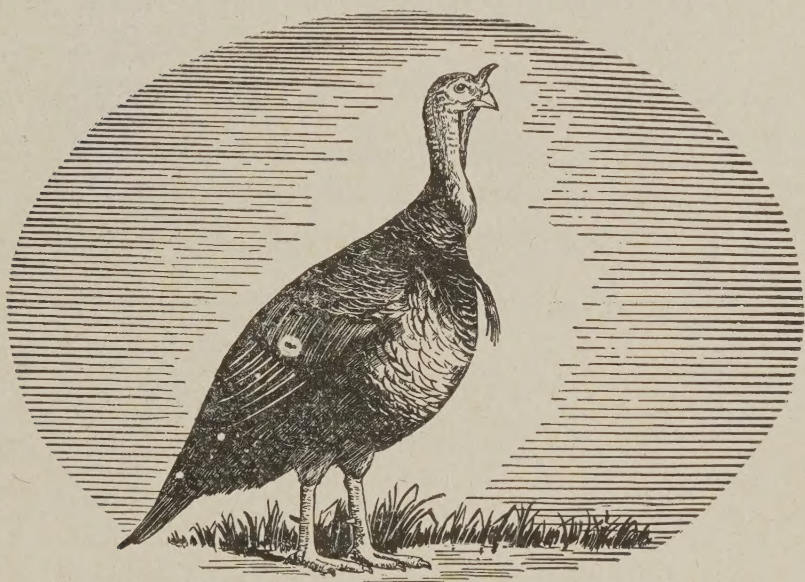

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RAISING TURKEYS

DUCKS · GEESE · GAME BIRDS

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Preface

THE PURPOSE of this book is to provide up-to-date information on raising and marketing turkeys, ducks, geese, guineas, pigeons, peafowl, upland game birds, and aquatic game birds. The conservation of upland and aquatic game birds in the wild is also discussed.

Carefully chosen illustrations dealing with the more important problems discussed are an outstanding feature of the book.

This book is a companion to "Successful Poultry Management" and is intended primarily for the use of vocational agriculture students, other farm youth, and their parents. The book should also be very useful to those who specialize in raising any of the various kinds of birds mentioned above.

The author is indebted to the following three staff members of the University of Maryland poultry department for reviewing the material and for making numerous valuable suggestions: Dr. Mary Juhn, who kindly read the entire manuscript; Dr. G. M. Briggs, who reviewed Chap. 5; Prof. E. W. Glazener, who reviewed Chaps. 1 and 2.

The author hopes that this book may be of real service to all interested.

MORLEY A. JULL

Contents

PART II—RAISING DUCKS, GEESE, GAME BIRDS, AND OTHER BIRDS

Editor's Foreword

THE turkey business is a big business, and turkey raising is an important agricultural enterprise throughout the United States. To realize this, one has but to review annual production, note the spread of the enterprise, and glance at the income figures expressed in American dollars. This income is derived from both farm and commercial flocks.

The rapid strides made in turkey breeding in the past twenty years have placed on the dining tables of the American people a very superior bird. Increased quality and quantity of meat have been secured—along with economy in production—largely owing to the development of better shaped, faster growing strains of turkeys making more efficient use of the feeds consumed. Still greater improvement in turkey breeding may be expected in the future.

During recent years the turkey industry has shown a tendency to expand because production has been relatively profitable. New growers are entering the field. There is a distinct need for practical instruction and assistance on the numerous problems involved in turkey production, a highly specialized phase of the poultry industry.

Comparable in many ways to the problems involved in turkey raising are those involved in the production of ducks, geese, game, and other birds. It is because of this fact that the author has appropriately included as a part of this book chapters dealing with the raising of such fowl.

In "Raising Turkeys, Ducks, Geese, Game Birds," which is a companion book to "Successful Poultry Management," the author—Dr. M. A. Jull, a well-known national authority in his field—stresses good management and good stock. Good management is largely the product of systematic study and practical experience. Whether the reader is a person becoming established in a specialized poultry business, a farm flock producer, or a seasoned commercial raiser, the discussions included should prove invaluable.

Outstanding features of this book are the logical activity basis of organization of the subject matter involved; the clear-cut, straightforward manner in which the story is unfolded; the simple understandable

1. Keeping Good Turkey Stock

THE kind of turkey that gives best results is the kind that grows rapidly, has relatively little mortality, has good body type, and is well fleshed, especially over the breast and thighs. These are the factors in which farmers and commercial raisers are particularly interested. Turkey breeders who produce hatching eggs, poults, and breeding stock for sale are also interested in such factors as efficient egg production, high fertility and hatchability, and good plumage color, especially in certain varieties. These desirable characteristics can be attained best by keeping stock that has been bred for them. Mongrel stock will not do. Before a flock of turkeys can be expected to give good results it must have been secured from breeding stock that was beed for specific purposes according to certain standards.

The following activities are discussed in this chapter:

1. Improving the Wild Turkey
2. Choosing Varieties of Turkeys
    - Choosing Standard-bred Varieties
    - Choosing Other Varieties
    - Identifying Defects and Disqualifications
3. Selecting a Profitable Strain
    - Deciding on Size of Bird to Raise
    - Selecting a Rapid-growing Strain
    - Securing Good Fleshing on Breast and Thighs
    - Keeping a Strain that Utilizes Feed Efficiently
    - Keeping a Good Laying Strain
4. Judging Breeding Stock
    - Participating in Turkey Shows
    - Judging by Score Card and by Comparison

1. Improving the Wild Turkey

It it worth noting that one of the largest wild game birds that has been domesticated should become known as "The National Thanksgiving Bird" of various countries. Such is the role the turkey has played for many decades.

As a wild fowl in North America, the turkey supplied numerous tribes of Indians and the early white settlers with "game" fowl in great abundance. In later times in numerous countries roast turkey from domesticated flocks came to be regarded as essential in the proper celebration of certain holidays. In addition, the consumption of turkey meat at other times of the year has steadily increased, especially in the United States.

There are two kinds of wild turkey, the Ocellated turkey native to the Yucatan Peninsula of Mexico and adjoining territory, and the

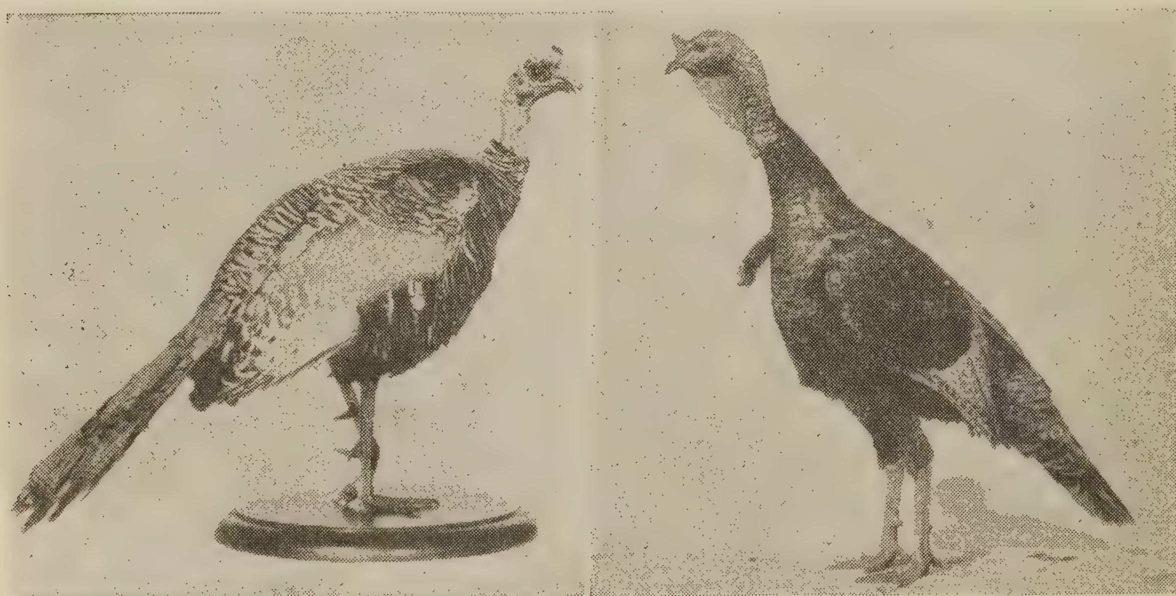


FIG. 1.—Left, Ocellated turkey of Central America. (*Smithsonian Institute*). Right, Wild North American turkey from which domestic varieties have descended. (*U. S. Department of Agriculture.*)

North American wild turkey (see Fig. 1). Domestic varieties are descended from the North American kind.

In its original habitat the wild turkey of North America ranged from central Mexico eastward of a line running roughly through the center of Arizona to the southeastern part of Minnesota and from southern Wisconsin, Michigan, and Ontario to as far east as southern New Hampshire, thence southward over the Atlantic Coast states.

The domestic turkey is the only race of poultry that has descended from wild stocks native to the United States. At the time of the discovery of this country it had been domesticated by the natives. Not only was turkey meat relished by the Indians, but they used feathers to adorn headgear and to make robes and blankets.

What man has accomplished in improving the economic qualities of wild stocks is really remarkable. As a matter of fact, well-bred turkeys properly managed are one of the most efficient classes of livestock for converting feed into meat for human use. *Wild* turkeys vary in size according to age, but well-grown males in the late fall often weigh from 11 to 13 lb. and well-grown females from 7 to 9 lb. Adding the average male weight and the average female weight and dividing by two gives an average weight of 10 lb. for both sexes. By contrast, the average live weight of *domestic* turkeys of both sexes sold on the markets throughout the United States during recent years has been about 15 to 16 lb. This increase in weight of domestic over wild turkeys at marketing time has been accomplished through breeding, feeding, and improved methods of management practiced over the years. It is interesting to observe that from 1936 to and including 1942 the average live weight of turkeys marketed steadily increased, as the following figures show.

Year	1936	1937	1938	1939	1940	1941	1942	1943
Average live weight.......	14.7	14.8	14.9	14.9	15.1	15.9	16.3	16.1

Shortages of certain feedstuffs in 1943 were probably responsible for the slight decrease in average live weight as compared with 1942.

Much of this progress is due to the adoption of better husbandry practices, especially the selection of better breeding stock from year to year by turkey breeders and the more extensive purchase of standard-bred poults by farmers and commercial turkey raisers.

2. Choosing Varieties of Turkeys

Standard-bred turkeys are those that have been bred according to certain standards of body type, plumage color, and other characteristics. The recognized authority for establishing standards for different breeds and varieties of poultry is the American Poultry Association, an organization of private poultry breeders in the United States, Canada, and Cuba. The association publishes the "American Standard of Perfection," which gives a description of the standards adopted for each of the breeds and varieties recognized by the association.

In the case of chickens, ducks, and geese there are several breeds and in many cases two or more varieties of different breeds. In the case of turkeys, however, there are only six varieties. We have breeds of chickens, ducks, and geese but not turkeys, because certain groups of the former birds differ greatly in shape; for example Leghorn and Plymouth Rock chickens, or Pekin and Muscovy ducks, or

Toulouse and African geese. All turkeys have about the same body shape.

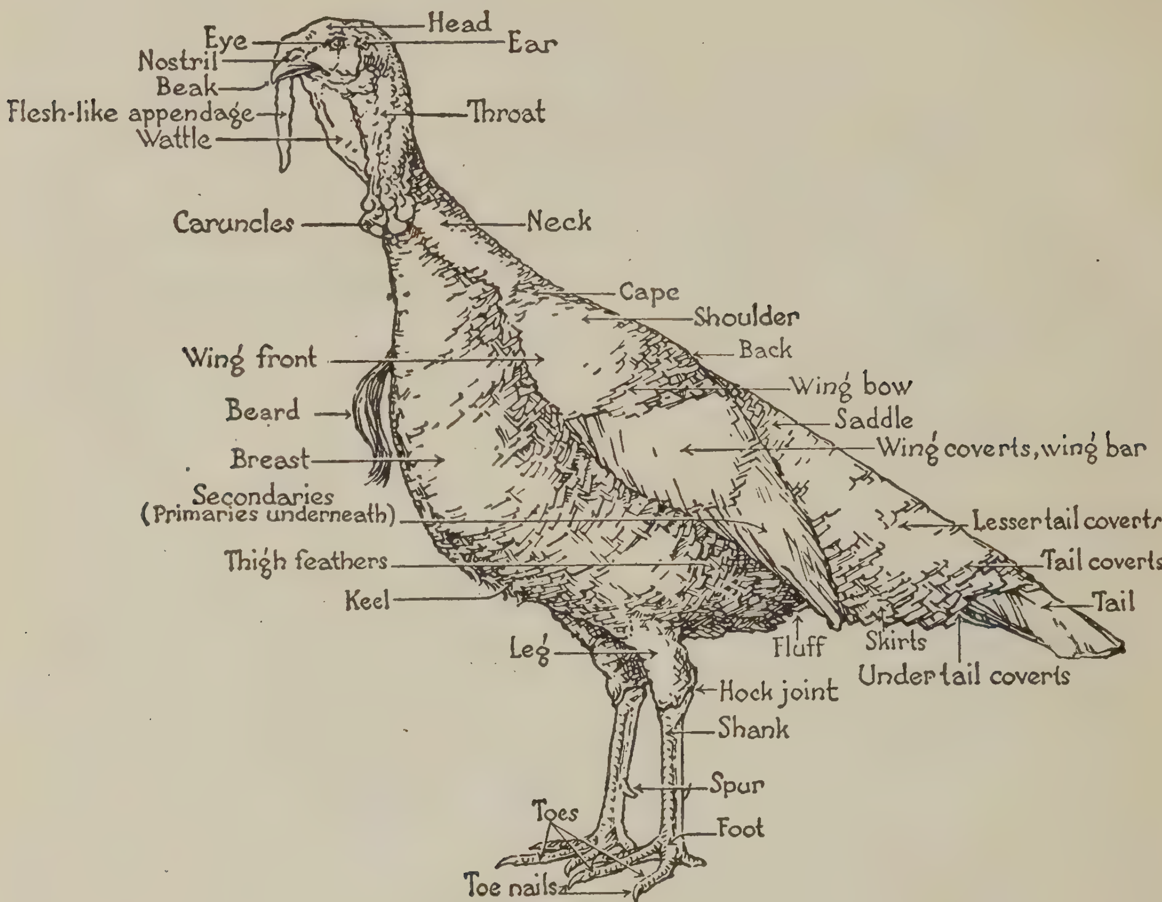


FIG. 2.—The external parts of the turkey and sections of the plumage. The fleshlike appendage on the head is sometimes called the "snood" or "leader." (*Illustration from "Fowls of the Forest and Stream Tamed by Man," by Morley A. Jull, courtesy of the National Geographic Magazine, March,* 1930.)

Before reading the descriptions of the varieties of turkeys which follow, study Fig. 2 in order to become familiar with the different terms used to describe the plumage and other parts of the live bird.

TABLE 1. WEIGHTS OF STANDARD-BRED VARIETIES

Variety	Hen			Tom		
	Young	Yearling	Adult	Young	Yearling	Adult
Standardbred Bronze	16	18	20	25	33	36
Narragansett, Bourbon Red, White Holland,* Black, Slate	14	16	18	23	30	33

* Recently proposed new weights for White Hollands are: young hen, 15; yearling hen, 18; adult hen, 18–20; and young tom, 25.

Choosing Standard-bred Varieties. There are at present six standard-bred varieties of turkeys, including the Standardbred Bronze, Narragansett, Bourbon Red, White Holland, Black, and Slate (see Figs. 3 and 5*a*). As mentioned before, these six varieties have

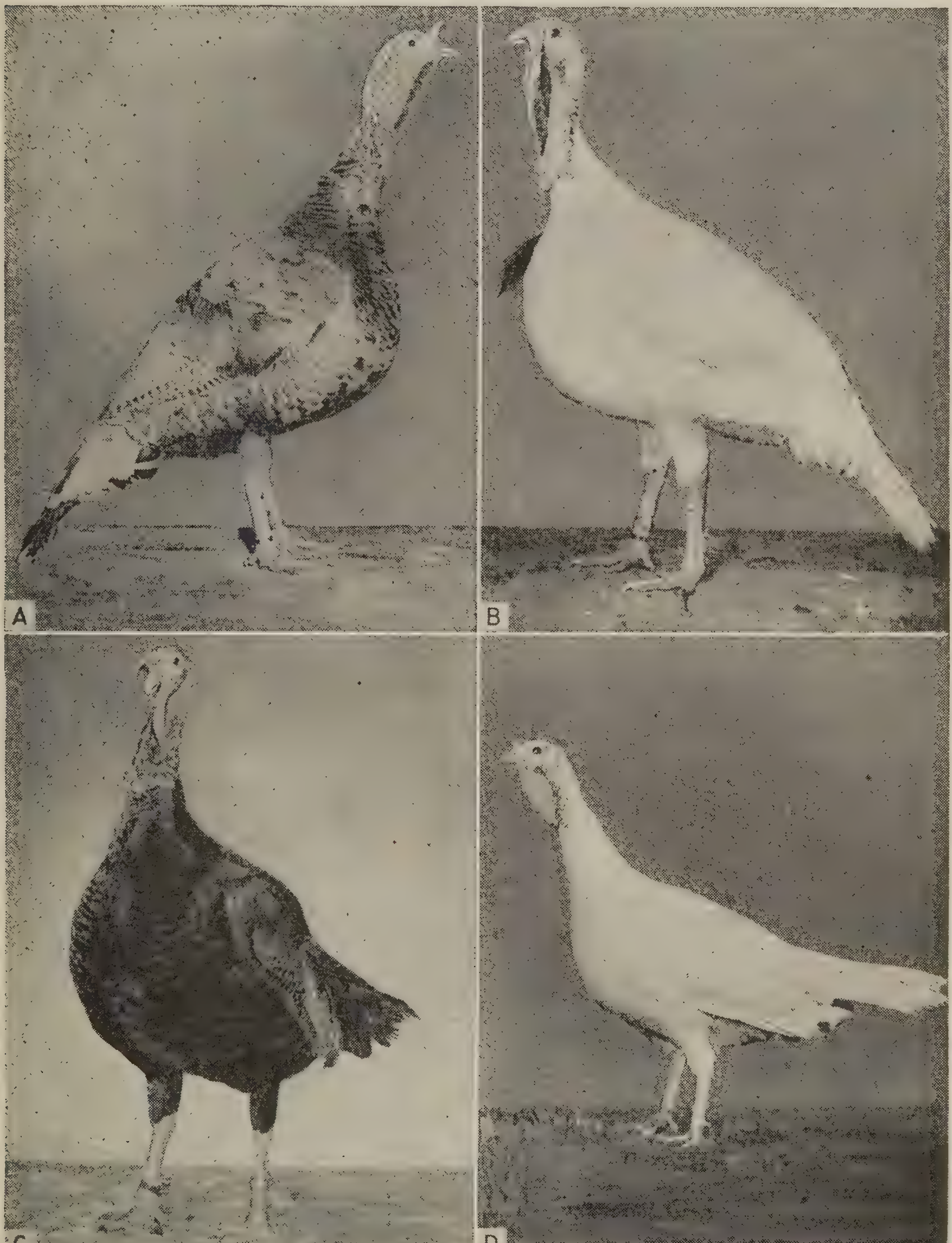


FIG. 3.—Top left, Standardbred Bronze. Top right, White Holland. Bottom left, Broad-breasted Bronze. Bottom right, Beltsville Small-type White. (*Turkey World.*)

approximately the same body shape, although the Bronze variety is larger than the others, as shown in Table 1.

For many years the Standardbred Bronze has been by far the most popular variety kept in this country and Canada, although some of the other varieties have more recently been increasing in popularity. For purely meat-production purposes, it might be supposed that solid-colored varieties like the White Holland and the Black would be popular because maintaining standard color would not be such a

Fig. 4.—Showing standard markings on plumage of different sections of Standardbred Bronze. (*Turkey World.*)

problem as in the other varieties. Maintaining standard color in the Bronze, Narragansett, and Bourbon Red varieties requires carefully selected matings, or the distinct feather markings and desirable plumage pattern soon deteriorate.

A brief plumage and shank color description of each of the six standard-bred varieties is given in Table 2.

Choosing Other Varieties. In addition to the six standard-bred varieties, there are several others which as yet have not been recognized as standardbred. Among the nonstandard varieties may be mentioned the Jersey Buff, the Royal Palm, the Crimson Dawn, the Nittany, the Broad-breasted Bronze, and the Beltsville Small-type White. The last two are the most important economically and are apparently gaining in popularity. Their weights are given in Table 3.

By comparing the weights given in Table 1 and Table 3, it is apparent that the Broad-breasted Bronze is the largest and the Beltsville Small-type White the smallest of all of the varieties mentioned. The increased size of the Broad-breasted Bronze over the Standard-bred Bronze is due to more extensive fleshing on the breast and

TABLE 2. COLOR OF STANDARD-BRED VARIETIES
(S. J. Marsden and C. W. Knox, Bureau of Animal Industry, U.S. Department of Agriculture 1937)

Variety	Plumage color	Shank color
Bronze	Ground color is dull black but the exposed surfaces of the feathers are glossed with rich iridescent red green on the fore part of the body and with a brilliant copper-colored bronzing, edged with black on the rear half. On the tail, tail coverts, and sides there is, in addition, a terminal edging of white, which also appears on the breast feathers of the female. Main tail feathers and tail coverts are distinctly penciled, medium brown and black	Blackish in young birds, pinkish in adults
Narragansett	The plumage pattern resembles that of the Bronze, but there is no red-green sheen and no bronzing. The Narragansett colors are metallic black with light steel-gray edging bordered in certain sections by a narrow black band on the ends of the feathers; main tail feathers and tail coverts distinctly penciled, light brown and black	Blackish salmon in young birds; deep salmon in adults
Bourbon Red	Dark brownish red with white wings. The breast feathers have narrow black tips which, in the females, are bordered with white. The tail is white with an indistinct reddish bar near the end	Reddish brown in young birds, reddish pink in adults
White Holland	White in all sections	Pinkish white
Black	Black in all sections	Slate black in young birds; pink in adults
Slate	Slate color in all sections	Pink

TABLE 3. WEIGHTS OF BROAD-BREASTED BRONZE AND BELTSVILLE SMALL-TYPE WHITE VARIETIES

Variety	Hen			Tom		
	Young	Yearling	Adult	Young	Yearling	Adult
Broad-breasted Bronze	18	20	22	32	38	41
Beltsville Small-type White	11½	12½	13	21	24	25

thighs. The relatively shorter shanks and broader breast gives the Broad-breasted Bronze the appearance of a more blocky conformation than the more upstanding Standardbred Bronze.

Fig. 5*a*.—Top left, Narragansett. Top right, Black. Bottom left, Bourbon Red. Bottom right, Slate. (*Turkey World.*)

The Broad-breasted Bronze was first developed in the Pacific Coast states and it has in general the same plumage pattern as the Standardbred Bronze. At present the term "broad-breasted" is limited to a variety whose members have breasts at least $3\frac{1}{2}$ in. wide at a point $1\frac{3}{4}$ in. above the keel when selected for breeding. Perhaps standard-bred and broad-breasted strains some day will be so thoroughly interbred that one variety of Bronze will emerge. In the meantime it would probably be well to recognize two subvarieties. The Beltsville Small-type White turkey was developed at the U.S.

Agricultural Research Center at Beltsville, Md., to fill the needs of the average family as revealed by consumer preference studies at various retail stores.

FIG. 5*b*.—Top left, Nittany. (*P. H. Margolf, Pennsylvania Experiment Station.*) Top right, Crimson Dawn (*U.S. Department of Agriculture*). Bottom left, Jersey Buff (*George C. Crandall, New Jersey Experiment Station*). Bottom right, Royal Palm. (*Enoch E. Carson, Florida.*)

Identifying Defects and Disqualifications. Although the standard weights and color of each of the six standard-bred varieties have been given, it should be pointed out that in most flocks there are a good many birds that do not measure up to the standards. As a matter of fact, very few flocks of any variety attain standard weights of that variety and still fewer flocks, except perhaps White Holland and Black, have many birds that approach perfection in plumage color and pattern. The standards are desirable, however, to serve as goals to be achieved, insofar as possible, by selection and breeding.

Defects. Practically all turkey breeders want their birds to conform reasonably well to standard-bred requirements. Since so few birds approach perfection, however, the breeder must ever be on the alert against using in his breeding pens any birds that possess undesirable characteristics. Some of these undesirable characteristics are called "defects." They are usually of relatively minor importance, although some are so serious that birds possessing them should not be used as breeders. Defects, however, do not prevent a bird from winning a prize in the showroom, providing the bird is otherwise worthy of a prize.

Some of the more serious defects include the following: (1) a dented breastbone or keel; (2) slightly bowed legs or knock-knees; (3) crooked toes; (4) a missing primary, secondary, or main tail feather; (5) tail feathers not fully developed. Besides these defects, which apply to all varieties, some birds of each variety may have certain color defects.

Standardbred Bronze color defects that should be guarded against include the following: (1) a greenish cast; (2) bronze color projecting beyond white edging of coverts; (3) brown in the end of the main tail feathers; (4) gray barring at the base of the main tail feathers.

Narragansett color defects include: (1) bronze or green sheen in plumage of back, body, fluff and tail; (2) insufficient black bands on greater tail coverts; (3) a break in the black on the back, giving the back a "mealy" appearance, a condition more often found in females than in males; (4) gray barring at the base of main tail feathers.

Bourbon Red color defects include: (1) too light a shade of red; (2) "mealy" backs; (3) black anywhere in the female and too heavy a line edge of black in the male; (4) tendency of wing and tail coverts to be of lighter color than the body.

In Blacks, a brownish sheen in the main and lesser tail coverts and gray in the wings and at the base of the tail are objectionable.

Disqualifications. These are more important to the breeder than defects because some of them are of greater economic importance and each of them prevents a bird possessing one from winning a prize in the showroom. Disqualifications applying to all varieties include (1) a decidedly crooked breastbone or keel; (2) pronounced bowed legs or knock-knees (see Fig. 6); (3) general unfitness; (4) deformed beak, tail, back, or wings; (5) slipped wing, split wing, or clipped wing; (6) one or more permanently deformed main tail feathers; (7) stubs on shanks; (8) below standard weight by more than 6 lb., except that practically no birds are disqualified for underweight before December 1.

Standardbred Bronze turkeys are disqualified at the exhibition if they have any white feathers anywhere or if there is one or more solid-colored feathers among the coverts, primaries, secondaries, or

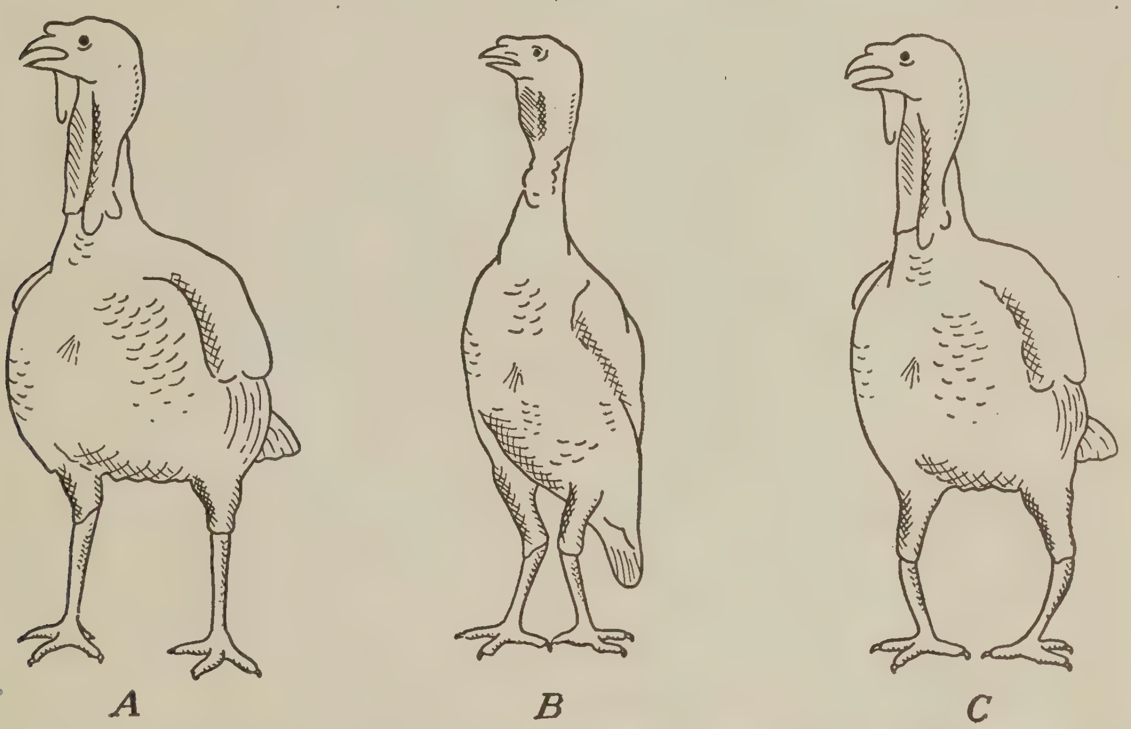


Fig. 6.—Sturdy legs placed squarely under the body, as in *A*, are characteristics of vigor and health. Pronounced knock-knees, as in *B*, and pronounced bowed legs, as in *C*, indicate physical weakness and are disqualifications.

main tail feathers. Absence of barring more than half the length of the primaries or lack of bronzing on the back also disqualify. Narragansett color disqualifications are the same as in the Bronze as far as wings and tail are concerned and, in addition, complete absence of black bands on the greater tail coverts. Bourbon Red color disqualifications are limited to primaries, secondaries, and main tail feathers showing more than one-third of any other color than white. White Holland disqualifications include any solid-colored feather other than white and decidedly off-colored legs. Blacks are disqualified if they have any feathers other than black in any part of the plumage. Slate disqualifications consist of any feathers other than slaty or ashy blue in any part of the plumage.

3. Selecting a Profitable Strain

Production qualities are necessary for making profit in raising turkeys. Of course, you want to raise birds that have standard-bred plumage color and are relatively free of defects and disqualifications. You also want to produce the size of market bird your customers prefer and you want to do it as economically as possible, particularly from the standpoint of the number of pounds of feed required to produce each pound of gain in growth. This means that you must have fast-growing turkeys that produce an abundance of flesh on the breast and thighs on as few pounds of feed as possible. If you are a turkey breeder you also want to keep a good laying strain in order to produce hatching eggs as economically as possible.

TABLE 4. PERCENTAGE OF PROTEIN AND FAT IN EDIBLE PORTION OF FOUR VARIETIES SLAUGHTERED AT 28 WEEKS OF AGE

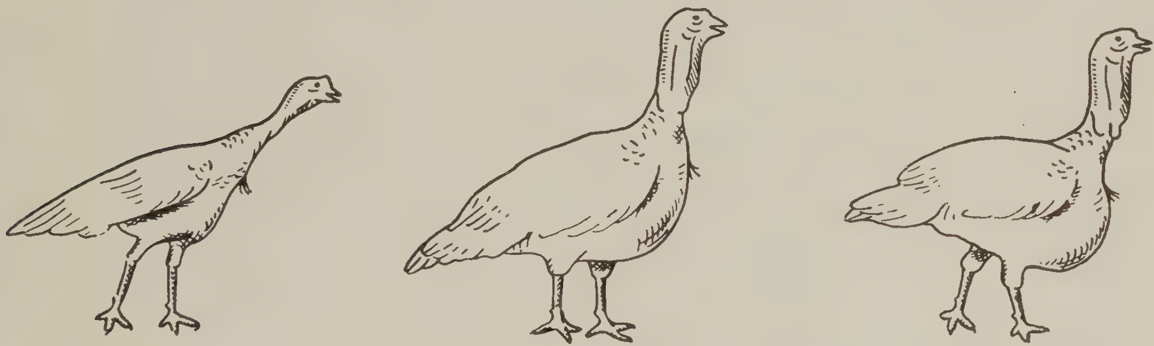
(H. M. Harshaw, W. L. Kellogg, R. R. Rector, and S. J. Marsden, U.S. Department of Agriculture, 1943)

Variety	Live weight, pounds		Protein, per cent		Fat, per cent	
	Males	Females	Males	Females	Males	Females
Broad-breasted Bronze	24.0	15.1	21.2	20.1	9.1	14.3
Standardbred Bronze	19.8	12.6	20.5	19.7	13.7	16.9
White Holland	18.5	11.2	20.3	19.5	14.1	17.9
Beltsville Small-type White	15.3	9.0	20.6	19.1	12.7	20.7*

Turkey raisers often change from one variety to another variety with the hope of securing better results. Beginners are often in a quandary as to which variety of turkeys should be selected. Each variety has its good qualities, and from the standpoint of efficiency of production there is not much difference among the varieties, providing stock from a good strain is kept. On the average, Broad-breasted Bronze turkeys are likely to have a slightly higher percentage of flesh on the breast and thighs in relation to body weight than most other varieties. On the other hand, Beltsville Small-type White, Black, and Bourbon Red turkeys are usually in a prime condition for market from about 2 to about 4 weeks earlier than Standardbred Bronze and especially the Broad-breasted Bronze turkeys. Table 4 gives data on the percentage of protein and fat in the total edible portion of four varieties reared together, fed the same diets, and slaughtered at 28 weeks of age.

The data in Table 4 show that the smaller the bird, especially females, the higher the percentage of fat in the edible portion of dressed birds. In other words, small-sized varieties are usually ready for market sooner than large-sized birds because they are in better "finish." Because small-sized birds were relatively fatter than large-sized birds, the percentage of protein in the edible portion was relatively lower in small-sized birds than in large-sized birds.

Some varieties have the reputation of being somewhat harder to pluck than other varieties, their pinfeathers being more noticeable



A B C

FIG. 7.—*A* is too long in the shanks and has a shallow breast. *B* is a well-balanced bird. *C* is perhaps too short in the shanks and is too heavy in front.

when the birds are dressed for market. Hatchability is apt to be lower in Broad-breasted Bronze than in other varieties. The cost of poults of a small variety per pound of turkey meat produced is relatively greater than in the case of large varieties. These are some things all turkey growers should keep in mind with respect to the different varieties of turkeys, but the most important thing of all is the kind of strain of any particular variety.

There are good and poor strains in each variety. Whatever variety you decide to raise be sure to select the best possible strain of that variety. For best results in your turkey enterprise, you want birds that are neither too long nor too short in the shanks and that have well-balanced bodies. The next chapter, on Breeding for Efficiency of Production, tells how to go about selecting a superior strain of any variety.

Deciding on Size of Bird to Raise. If you have a good market for large-sized live or dressed birds and have no difficulty in disposing of very large toms, a good strain of the Broad-breasted Bronze should be suitable. Hotels and restaurants are good customers for large-sized birds for slicing meat to make sandwiches, and for other purposes.

If customers prefer medium-sized birds, a good strain of any of the six standard-bred varieties should be suitable. If you want to produce a family-size turkey that will fit many family pocketbooks and ovens, the Beltsville Small-type White or other similar varieties would be suitable.

Keep in mind that the average price paid for market birds is according to size. Large-sized birds are often quoted at somewhat lower prices than medium-sized and small-sized birds. In spite of this, it is possible for producers of large-sized birds to secure as good returns from the turkey enterprise as producers of small-sized birds because of the greater poundage of turkey meat produced in relation to the pounds of feed consumed. On the other hand, consumers might purchase turkey more frequently if small-sized birds were more readily available.

To give some idea of the weights that should be attained by young toms and hens as they approach marketing time, Table 5 has been prepared. Since males grow faster than females, the weights of the sexes are given separately. If you weigh your males and females together and want to compare the weights at any age with those given in Table 5, add the weights of the sexes in the table and divide by two.

TABLE 5. APPROXIMATE WEIGHTS IN POUNDS THAT SHOULD BE ATTAINED BY WELL-BRED TURKEYS OF DIFFERENT VARIETIES FED WELL-BALANCED DIETS AND GIVEN PROPER MANAGEMENT

Variety	Age, weeks									
	24		26		28		30		32	
	♂*	♀†	♂	♀	♂	♀	♂	♀	♂	♀
Broad-breasted Bronze	22	14	24	15	26	16	28	17	29	17.5
Standardbred Bronze	18	11	20	12	22	13	23	13.5	24	14
White Holland	16.5	10.5	18.5	11.5	20	12	21	12.5	22	13
Narragansett, Bourdon Red, Black	15.5	10	17.5	11	19.5	12	20.5	12.5		
Beltsville Small-type White	14.5	9	16	9.5	17.5	10	18.5	10.		

* ♂ represents male.
† ♀ represents female.

Selecting a Rapid-growing Strain. Wild turkeys usually grow at a slower rate than most strains of domestic varieties. Different strains of any domestic variety may grow at different rates, however, even when fed and managed the same, as shown in Fig. 8. The faster the growth, usually the fewer the pounds of feed consumed per pound of gain in weight. That is why it is so important to select rapid-growing strains of poults to raise.

Securing Good Fleshing on Breast and Thighs. Every customer who goes to buy a turkey wants one with a plump breast. So

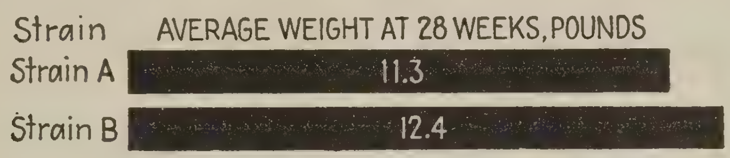


FIG. 8.—Bronze females of strain *B* weighed 1.1 more pounds per bird at 28 weeks of age than Bronze females of strain *A*, both strains fed and managed the same. (*Graph made from data of V. S. Asmundson and I. M. Lerner, University of California*, 1942.)

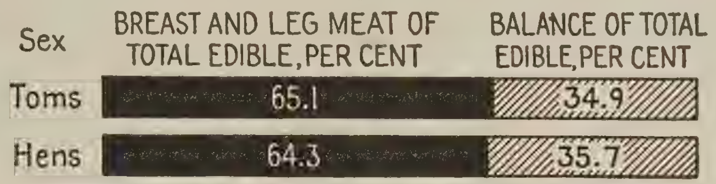


FIG. 9.—In reasonably well-fattened dressed toms and hens at 28 weeks of age, the edible meat on the breast and legs amounted to about 65.1 and 64.3 per cent, respectively, of the total amount of edible meat. (*Graph made from data of H. M. Harshaw andR. R. Rector, U. S. Department of Agriculture*, 1940.)

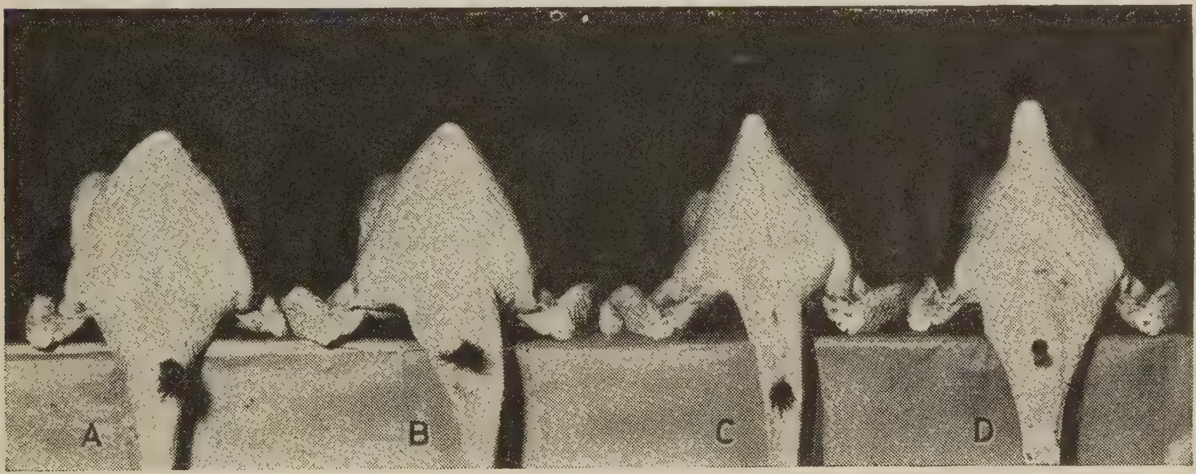


FIG. 10.—You should try to produce the kind of turkey that will give consumer satisfaction, such as birds *A* and *B*. A poorly fleshed bird is shown in *C* and a very poorly fleshed bird in *D*. (*S. J. Marsden, Bureau of Animal Industry, U.S. Department of Agriculture*, 1940.)

do you when you select a turkey for home use. And the bigger the "drumsticks," the more pleased are the "kiddies" in the family. In reasonably well-fattened turkeys at about 28 weeks of age the edible meat on the breast and thighs amounts to about 65 per cent of the total amount of edible meat, as shown in Fig. 9. In unfattened and immature birds the percentage of breast and leg meat to total edible meat is naturally relatively low. Also, in the extremely "slab-sided" type of turkey, the amount of meat on the breast and legs is quite sparse (see Fig. 10, *D*). You would not want birds like *C* and *D*, shown in Fig. 10, on your table and your customers do not like to buy such poorly fleshed birds.

One of the greatest needs of the turkey industry is an improvement in the average quality of market birds, especially with respect

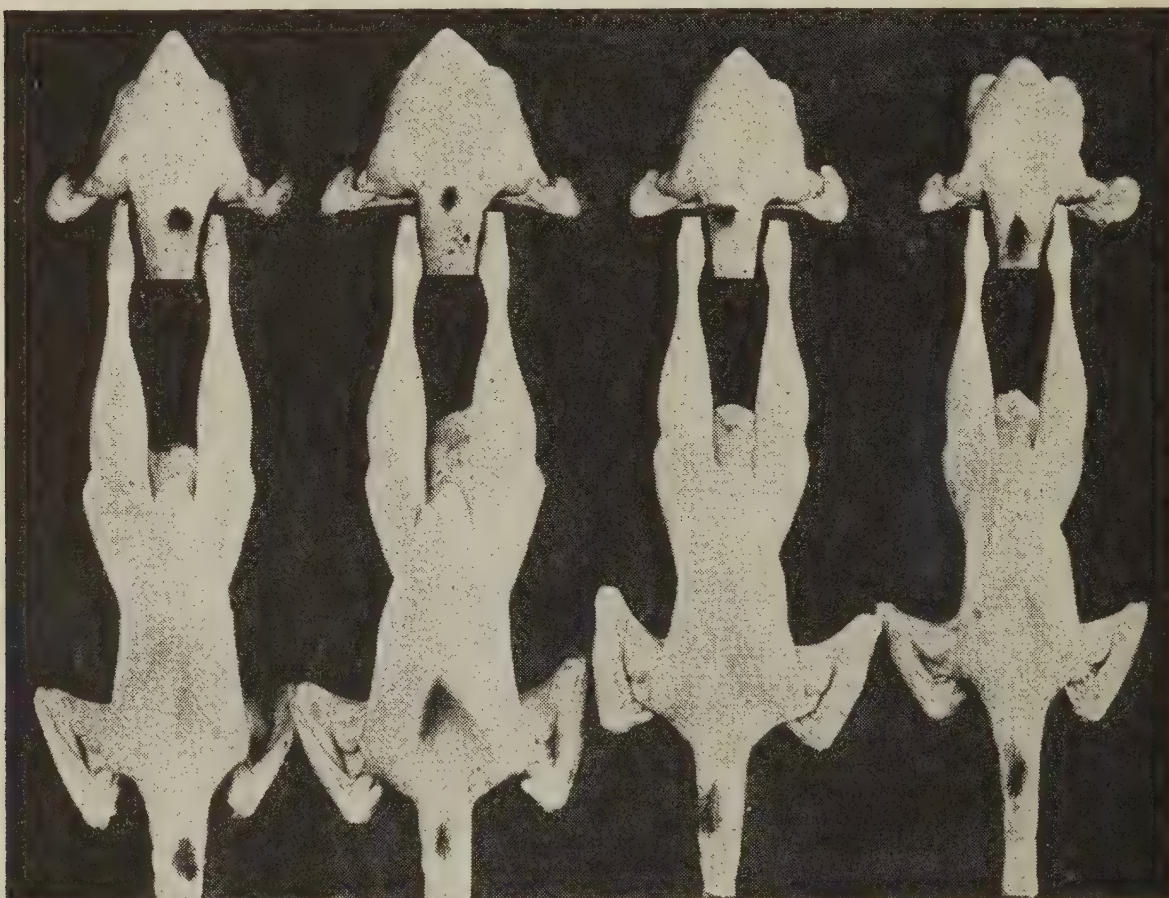


Fig. 11.—From left to right, typical dressed carcasses of Standardbred Bronze, Broad-breasted Bronze, White Holland, and Beltsville Small-type White at 28 weeks. (*H. M. Harshaw, W. L. Kellogg, R. R. Rector, and H. W. Titus, U.S. Department of Agriculture*, 1943.)

to the relative amount of fleshing on the breast and thighs. Figure 11 shows typical dressed carcasses of males and females of Standardbred Bronze, Broad-breasted Bronze, White Holland, and Beltsville Small-type White turkeys at 28 weeks of age.

If you are a turkey breeder, set a goal for the development, by selection and breeding methods, of the type of turkey that will produce an abundance of fleshing on the breast and thighs at marketing time according to the size of turkey you are breeding. If you are a turkey raiser who purchases all poults each year, make a point of securing poults from a breeder who is carrying on a sound selection and breeding program designed to develop birds that excel in the amount of fleshing on the breast and thighs.

Keeping a Strain That Utilizes Feed Efficiently. Most flocks of growing turkeys use too many pounds of feed per pound of gain in body weight. This is a very important matter because the cost of feed represents approximately one-half of the total costs of pro-

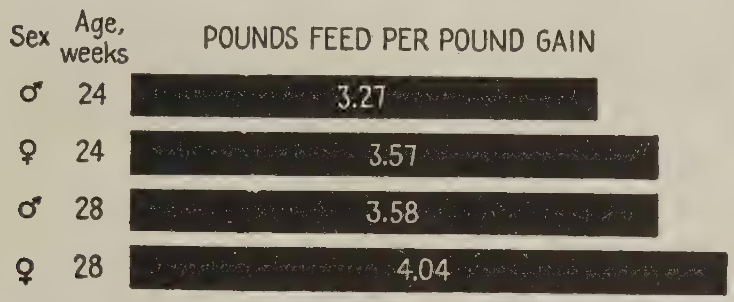


FIG. 12.—Toms, indicated by ♂, grow faster than hens, indicated by ♀, and therefore consume fewer pounds of feed per pound of gain in weight. At 24 weeks these Broad-breasted Bronze toms weighed 23.4 pounds and had consumed 76.6 pounds of feed; at 24 weeks the hens weighed 14.1 pounds and had consumed 50.4 pounds of feed. At 28 weeks the toms weighed 28.1 pounds and had consumed 100.7 pounds of feed; the hens weighed 16.4 pounds and had consumed 66.2 pounds of feed. The birds were raised on range. (*Graph made from data of E. I. Robertson and J. S. Carver, Washington Experiment Station,* 1941.)

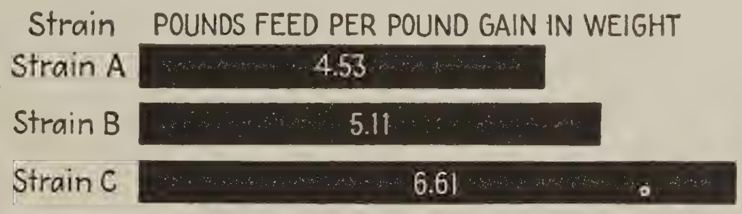


FIG. 13.—Strain *C* consumed an average of 1.50 more pounds of feed per pound gain in body weight up to 28 weeks than strain *B* and 2.08 more than strain *A*. (*Graph made from data of Iowa Agricultural College,* 1940.)

ducing turkey meat. Fast-growing strains utilize feed more efficiently than slow-growing strains because fewer pounds of feed are consumed per pound of gain in body weight. The problem of efficiency in feed utilization is, therefore, very important to a turkey raiser.

Since males grow faster than females, growing toms utilize their feed somewhat more efficiently than growing hens, as indicated by the data in Fig. 12.

Within any variety of turkeys, strains may differ markedly with respect to the efficiency in utilizing feed to produce meat, as shown in Fig. 13. Fast-growing strains utilize their feed more efficiently than the slow-growing strains, much more so when the fast-growing strains have good fleshing properties.

Of course, the kind of diets fed and the way you manage your flock of poults also affect efficiency in feed utilization. Skimpy feeding is uneconomical because the poults are unable to grow so fast as they otherwise would. Poor management, such as allowing the water pans to go dry for any length of time, lack of sufficient mash hopper feeding space, or unsanitary conditions that spread disease, prevents the poults from utilizing their feed to best advantage.

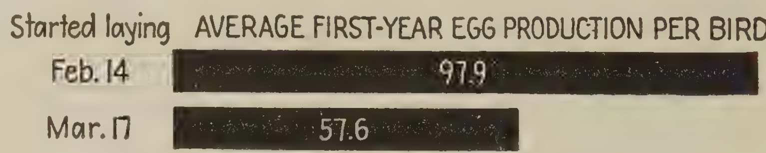


Fig. 14.—For each of five consecutive years from 1934 to 1938 early-maturing strains of turkeys started laying about one month earlier than late-maturing strains and laid about 40 eggs more per bird. (*Graph made from data of V. S. Asmundson, University of California*, 1941.)

Granted, however, that you feed well-balanced diets and manage the flock to the best of your ability, then be sure to secure fast-growing strains noted for good width of body in relation to body depth and shank length and also noted for relative plumpness of fleshing on the breast and thighs. This will give you the proper start toward your ultimate objective of producing as many pounds of turkey meat on as few pounds of feed as possible.

Keeping a Good Laying Strain. If you are a turkey breeder you should be eager to improve the laying ability of your flock because the poorer the egg production of the flock, the more it costs you to produce hatching eggs and poults. Moreover, by developing better laying strains, turkey breeders should be able to sell hatching eggs to hatcheries at lower cost than at present, and turkey raisers who buy poults every year should be able to secure them at lower cost than at present.

The data in Fig. 14 show that it is possible to secure increased egg production by developing early-maturing strains. Also, by the use of artificial lighting it is possible to secure hatching eggs much earlier in the season. Lighting methods are discussed in the next chapter. Even under artificial lighting the individual records of egg production in any flock may vary from almost no eggs to over 100 eggs. In Fig. 15 are given the lowest and highest records made during the breeding season in a flock artificially lighted beginning December 1. The fact that such extreme variability in egg production exists in most flocks makes it possible to develop better laying strains by selection and breeding, as outlined in the next chapter. Many flocks today lay an average of about 25 eggs per bird during the entire breeding season, whereas other flocks average over 60 eggs. Under proper conditions a minimum average of 90 eggs by June 1 would seem to be a reasonable goal.

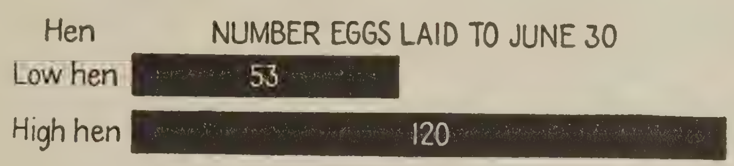


FIG. 15.—In almost every flock, egg production is quite variable. Some strains lay much better than other strains. Good egg production is necessary to reduce the cost of producing hatching eggs and poults. A good laying strain can be developed by selecting for breeding purposes the progeny of good laying hens. (*Graph from data of W. P. Albright and R. B. Thompson, Oklahoma Experiment Station*, 1933.)

4. Judging Breeding Stock

Success in producing a strain of birds of superior quality depends largely on the ability to select outstanding sires and dams. Before the turkey breeder can select outstanding sires and dams he must be a competent judge of turkeys. No individual bird is perfect and no two birds are alike. When turkeys are placed on display, they can be judged according to their relative merits. Turkey shows, therefore, have a distinct educational value because they teach breeders to pay more attention to defects of plumage pattern, body type, and other qualities that distinguish mediocre from outstanding individuals.

Participating in Turkey Shows. All turkey breeders should be encouraged to enter their birds in competition because they are then better able to appraise the relative merits of their own birds with those entered by other breeders. Prizes won have a distinct advertising value. Not all birds entered, however, can win prizes, and the turkey breeder whose birds do not win a prize should profit by learning wherein his birds are deficient. Then he can take steps to correct the deficiencies through the adoption of a better breeding program.

If you are planning to enter birds in a show, go over your flock several weeks before the show is to be held and band several of the best birds for the different classes provided for in the catalogue. Young turkeys well raised are usually in prime condition for showing when they are about seven or eight months old. Old turkeys are usually in good condition after the latter part of October. After banding a number of the most promising birds, go over them once or twice more before making the final selections.

Some time before the show is to be held go over each bird carefully, removing defective contour feathers but not defective main tail or main wing feathers because birds with such defects should not be entered in a show but should be marketed. Make the final selection just before delivering or shipping the birds to the show. If the head, legs, and feet are dirty, use mild soap and a small brush to remove the dirt and then rub the cleaned parts with a soft, dry cloth. After the legs and feet are dry they may be rubbed with olive oil and

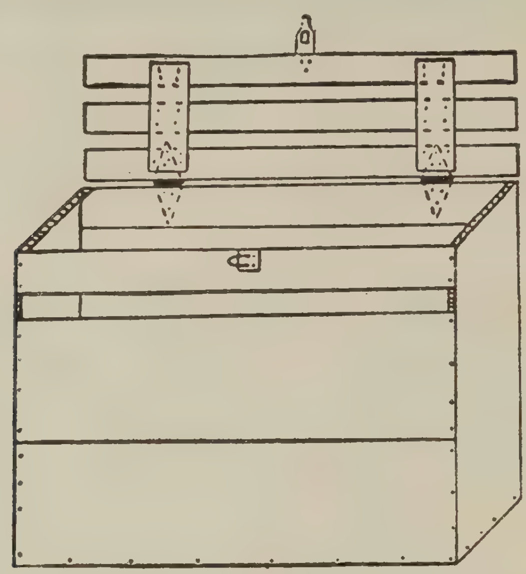


FIG. 16.—Diagram of shipping crate. (*H. H. Kauffman, Pennsylvania State College.*)

polished. Finally, band each bird with a sealed leg band to aid the show management in returning your birds to you.

TABLE 6. TURKEY SHIPPING CRATE DIMENSIONS, INCHES
(H. H. Kauffman, Pennsylvania State College, 1942)

Kind of bird	Height	Inside width	Outside length
Small females	30	10	36
Large females	30	11	36
Most males	30	12	42
Extra large males	30	13	48

Shipping crates should be large enough to accommodate the birds comfortably without damaging the plumage. At the same time the crate should not be too heavy or cumbersome to handle. Make the crate neat and durable and hinge the lid on one side opening over the top, as shown in Fig. 16. The proper dimensions for shipping crates are given in Table 6. Put at least 3 in. of loose shavings and 4 in. of chaff or similar material in the bottom of each crate. Attach a feed cup and a drinking cup at one end about 1 foot from the bottom of the crate. Paint your shipping crates a distinctive color so that the show management will be certain to return your birds in your own crates.

Judging by Score Card and by Comparison. The primary purpose of turkey shows is to encourage turkey breeders to exercise the greatest possible care in selecting breeding stock with a view toward producing the kind of progeny turkey raisers should keep. Therefore, the most important characteristics should receive the greatest consideration in any judging method that may be employed.

The score-card method of judging turkeys used by the American Poultry Association for many years and published in the "Standard of Perfection" allows 68 points for shape and 32 for color out of a total score of 100 for each bird. The number of points for the different sections of the bird is given in Table 7.

TABLE 7. A.P.A. SCALE OF POINTS FOR JUDGING BREEDING STOCK

Item	Shape	Color	Total
Symmetry	5	..	5
Condition and vigor	10	..	10
Weight	12	..	12
Head	3	1	4
Eyes	2	1	3
Throat-wattle	1	..	1
Neck	2	3	5
Wings	4	6	10
Back	6	5	11
Tail	4	6	10
Breast	10	4	14
Body and fluff	6	4	10
Legs and toes	3	2	5
Total	68	32	100

Note that symmetry, condition and vigor, and weight are given a combined valuation of 27 points. When 6 points for the shape of the back and 10 points for the shape of the breast are added to the 27 points it will be noted that 43 points are allotted to these most important characteristics. Plumage color is important in all standard-bred varieties, although from a purely economic standpoint it is not so important as such things as symmetry, which means a well-proportioned body, condition and vigor, and shape of breast.

Under the American Poultry Association system of judging, when all varieties on exhibition compete for sweepstake prizes, White Hollands and other whites are handicapped 2 points, Blacks are handicapped 1 point, and Slates are handicapped ½ point. This means that if a Bronze or a Narragansett or a Bourbon Red was given a score of 86 points, a White Holland a score of 87½, a Black a score of 86½, and a Slate a score of 86, the Bronze or Narragansett or Bourbon Red would be awarded the sweepstake prizes. The reason for handicapping the solid-colored varieties in awarding sweepstake prizes is because it is harder to attain perfection in color in the parti-colored varieties than in the solid-colored varieties.

Numerous White Holland turkey breeders have felt that the scale of points given in Table 7 allows relatively too many points for color, for the simple reason that, except for a bird disqualified because of a solid-color feather other than white, it is very difficult to differentiate between the color of any two birds that compete. In other words, the most important differences found among White Holland turkeys pertain to the shape of the bird. Therefore, the scale of points given in Table 8 was proposed for judging White Holland breeding stock.

Table 8. Scale of Points for Judging White Holland Breeding Stock

Item	Shape	Color	Total
Symmetry	5	..	5
Condition and vigor	10	..	10
Weight	5	..	5
Head and beak	3	1	4
Eyes	2	2	4
Neck	3	1	4
Wings	4	2	6
Back	10	2	12
Tail	3	2	5
Breast and keel	24	2	26
Body and fluff	4	2	6
Legs and toes	8	2	10
Skin	2	1	3
Total	83	17	100

Note particularly in Table 8 that 24 points are allocated to the shape of the breast and keel, 10 points to the shape of the back, and 8 points to the shape of the legs and toes, making 42 points to parts of the bird that vitally affect the appearance of the dressed market bird.

More recently a scale of points has been proposed by the National Turkey Federation for all varieties, with a view toward allocating points to different parts of the bird in relation to their relative importance. This scale of points is given in Table 9.

TABLE 9. N.T.F. SCALE OF POINTS FOR JUDGING BREEDING STOCK

Item	Shape	Color	Total
Symmetry and carriage	10	...	10
Condition and vigor	10	..	10
Weight	8	..	8
Head and neck	5	1	6
Wings and shoulders	5	3	8
Back and spring of rib	12	3	15
Breast and keel	25	3	28
Tail	3	3	6
Thighs and fluff	4	1	5
Legs and toes	3	1	4
Total	85	15	100

The score-card method of judging is particularly valuable for turkey breeders and turkey raisers who have had little or no experience in judging and comparing birds. In the case of many community-turkey shows of a local nature, however, turkeys are judged by the comparison method without scoring them. This method is usually quite satisfactory if done by an experienced judge.

Turkey breeders would make a notable contribution to the turkey breeding enterprise if classes at turkey shows were provided for a sire and a certain number of his progeny and a dam and a certain number of her progeny as well as classes for a sire and dam and a certain number of their progeny. Providing for such classes would be a great step forward in demonstrating the breeding worth of selected sires and dams according to the relative merits of their progeny.

SUMMARY

1. Purebred birds usually give better results than mongrels.

2. The different varieties are much the same in body shape but there are some marked differences in standard weights, the young tom and young hen weights being given here:

	Young tom	Young hen
Broad-breasted Bronze	32	18
Standardbred Bronze	25	16
White Holland	25	15
Black, Slate, Bourbon Red, and Narragansett	23	14
Beltsville Small-type White	21	11½

3. Some of the more serious defects are (*a*) a dented keel or breastbone; (*b*) slightly bowed legs or knock-knees; (*c*) crooked toes.

4. Disqualifications of economic importance include (*a*) a decidedly crooked keel or breastbone; (*b*) pronounced bowed legs or knock-knees; (*c*) general unthriftiness; (*d*) deformed beak, tail, back, or wings.

5. Strains of large-sized varieties usually grow faster than strains of small-sized varieties, but the latter are usually in prime condition for market somewhat sooner than the former.

6. Rapid growth is very necessary to enable poults to utilize feed most efficiently.

7. Ability to develop well-fleshed breasts is essential in market birds to command top prices.

8. Good egg production reduces the cost of producing hatching eggs and poults.

9. Participating in judging contests and scoring breeders helps one to become a better judge of good turkeys.

10. Whether you produce your own poults or purchase them, remember that good poults cannot be secured from poor breeding stock.

2. Breeding for Efficient Turkey Production

IN Chap. 1 it was pointed out that rapid growth, good fleshing over the breast and thighs, efficient utilization of feed, and good egg production were the most desirable traits of a profitable strain. These traits are all inherited and, therefore, can be improved in practically any flock by adopting the right kind of a selection and breeding program.

Not every turkey raiser should aspire to be a turkey breeder, however. Many turkey raisers do not have the facilities for carrying on pedigree breeding work, which provides the means for the most intelligent selection of breeding stock of superior quality. Many other turkey raisers do not keep enough turkeys to enable them to make sufficiently rigid selection of breeding stock to achieve much progress from year to year. Furthermore, carrying on a sound breeding program is time-consuming and relatively expensive and, in many cases, is hardly justified unless the flock owner has a good market for hatching eggs, poults, or breeding stock.

For those who are interested in turkey breeding problems, this chapter should be of particular interest. For those who buy poults every year, this chapter should also be of considerable interest because after reading it they will be better informed concerning the kind of breeder or hatchery operator from whom to secure their poults. The activities discussed in this chapter are

1. Developing a Turkey Breeding Program
    - Starting with Good Stock
    - Keeping One Variety Only
    - Breeding from Young or Older Stock
    - Avoiding Too Close Inbreeding
    - Practicing Outbreeding or Introducing New "Blood"
    - Determining Effects of Crossbreeding
    - Deciding on a System of Matings
2. Providing Good Houses or Shelters for Breeders
    - Deciding on Type of Shelter or House
    - Confining Breeders

3. Breeding for Good Body Type and Fleshing
    - Selecting Rapid Growing Poults for Breeding
    - Rejecting Birds with Abnormalities
    - Selecting for Good Conformation and Fleshing
4. Breeding for Good Egg Production
    - Using Artificial Lights to Stimulate Early Laying
    - Identifying the Best Layers
    - Keeping a Record of Egg Production
    - Selecting Breeders to Develop a Better Laying Strain
    - Selecting Early-maturing Families
    - Selecting Families That Have Few Pauses
    - Selecting Families That Lay at a Good Rate
5. Securing Good Fertility
6. Breeding for Good Hatchability
7. Breeding for Viability
8. Developing a Turkey Improvement Program in Cooperation with Hatcheries
    - Producing the Quality of Poults Turkey Raisers Need

1. Developing a Turkey Breeding Program

Starting with Good Stock. The results secured in raising turkeys depend to a great extent upon the kind of stock kept. Of course, the kind of diets fed and methods of management have a great deal to do with the results, but the fact remains that the best of diets and the most efficient management will not compensate for stock of poor quality.

The turkey breeder must carry on a definite breeding program, planning his selection and breeding methods with definite objectives in mind but making whatever changes become necessary from year to year to achieve progress. As a turkey breeder, remember that results secured are rarely stationary; you either go forward or slip backward with respect to the quality of progeny produced from year to year.

Keeping One Variety Only. There are definite advantages in keeping one variety only, unless you keep large numbers of breeding stock. In the preceding chapter attention was called to the fact that most flocks of turkeys need improving with respect to several different traits or characteristics. Select and mate birds each year that will improve your flock with respect to all these traits simultaneously rather than breed to improve one trait at a time. This means maintaining a reasonable number of breeding pens from year to year. Therefore, you need a relatively large number of progeny from which to select the very best birds for breeding purposes. A small flock owner is handicapped because of the limited number of birds from which he can select really outstanding prospective breeders. Even when several hundred turkeys are raised each year, keeping one variety only gives a much better chance of selecting for breeding purposes individual birds and families that are of superior breeding quality, than when two or more varieties are kept.

Breeding from Young or Older Stock. For the production of hatching eggs and poults to sell to turkey raisers who produce market

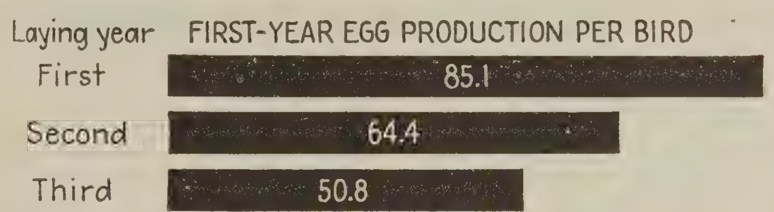


FIG. 17.—The egg-production records of 36 turkeys kept for three successive years decreased each succeeding year. (*Graph made from data of V. S. Asmundson and W. E. Lloyd, University of California*, 1935.)

turkeys exclusively, the use of young hens in their first-laying year and toms of similar age is quite justified, providing, of course, they are carefully selected for vigor, type, fleshing, and other desirable traits. One advantage in using young hens as compared with two-year-old and three-year-old birds is that during the first-laying year egg production is usually much better than in later years, as shown in Fig. 17. The data show that among 36 birds kept for three years, egg production decreased 24.3 per cent from the first to the second year and 21.1 per cent from the second to the third year.

Select and band young hens and toms for breeding purposes before the Thanksgiving birds are marketed. Go over these birds again and select and band more birds needed before any birds are sold for the Christmas market. At both times give particular attention to early-maturing birds. Young toms should be at least $8\frac{1}{2}$ months old at mating time, and young hens about 8 months old by the time they start laying.

Although turkeys usually lay best in their first-laying year, in carrying on the soundest kind of a breeding program you will want to hold over from one year to another those birds that proved to be the very best breeders the previous year as determined by the kind of progeny they produced.

Avoiding Too Close Inbreeding. Inbreeding is the mating of birds that are related. A male may be mated to his full sisters or to his dam or a sire may be mated to his daughters. All these forms of inbreeding are called "close inbreeding" if carried on for two or three years in succession. Less close inbreeding would be the mating of first cousins, or a sire with his nieces, or a tom with his aunt. Mating a sire to his daughters or a tom to his full sisters is sometimes practiced with good results by the specialist breeder who carries on pedigree breeding work. *Mild inbreeding*, such as the mating of cousins, is

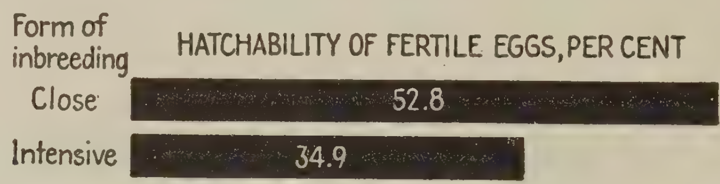


Fig. 18.—Intensive inbreeding is not recommended, but a certain amount of inbreeding may be very desirable in some flocks. (*Graph made from data of S. J. Marsden and C. W. Knox, Bureau of Animal Industry, U.S. Department of Agriculture,*1937.)

practiced quite freely by many turkey breeders and is probably desirable in order to "fix" certain desirable characters in the strain. Figure 18 gives the results secured with respect to hatchability in an experiment in which results from close inbreeding are compared with results from intensive inbreeding. *Close inbreeding* consists of mating full brothers and sisters among the progeny of full brother and sister matings for two years. *Intensive inbreeding* consists of mating full brothers and sisters or other forms of close inbreeding for from three generations to five generations.

The outstanding undesirable result secured from continued close inbreeding is lowered hatchability. Fertility and egg production are often not affected but viability of stock is liable to be affected adversely. If you wish to carry on mild or close inbreeding for a particular purpose, be sure to practice rigid selection of your breeding stock. If you have about 10 pen matings and consider the pedigrees of the breeders you select in making up your matings you are not liable to encounter any serious dangers from a certain amount of inbreeding.

Practicing Outbreeding or Introducing New Blood. Many turkey breeders attach too much emphasis to the supposed ill effects of any form of inbreeding. They think that they must introduce new "blood" of the same variety into their flock every year and some even go so far as to exchange toms of the same variety with their neighbors regularly. Introducing new blood into stock is desirable, of course, if it is of such mediocre quality that you are not securing the results you should in hatchability, growth, and fleshing. On the other hand, the best way to improve a mediocre flock is either to replace it entirely by purchasing poults of superior quality from an outstanding breeder, or to secure breeding stock of the same variety for a few years in succession from an outstanding breeder who is able to identify families of superior breeding worth.

In Table 10 are given the results secured in hatchability of fertile eggs in outbreeding seven different strains of Standardbred Bronze turkeys. The first year the breeding pens were mated so that the males and females in no two pens were of the same strain. From each mating the best young tom and young hens were selected each year. The young hens were placed in the same pen occupied by their parents but the tom was placed in the next pen so that tom from pen one was placed in pen two and so on. The toms, therefore, in the second year were mated to females of an unrelated strain. This revolving process was carried on for five years.

TABLE 10. HATCHABILITY OF FERTILE EGGS FROM OUTBRED MATINGS
(S. J. Marsden and C. W. Knox, Bureau of Animal Industry, U.S. Department of Agriculture, 1937)

Year	First	Second	Third	Fourth	Fifth
Per cent hatchability	55.2	56.5	71.4	68.7	74.9

The results secured show that outbreeding, if practiced along with the careful selection of females and males used for breeding purposes, improved hatchability. In this particular experiment egg production and egg weight were not materially affected.

Determining Effects of Crossbreeding. Crossbreeding consists of mating a tom of one variety with hens of another variety. Relatively little experimental work has been done to determine the effects of crossing different varieties of turkeys.

Table 11 contains results secured with respect to fertility and hatchability of eggs incubated and viability of poults to 4 weeks of age from various purebred and crossbred matings. Each purebred male was mated to purebred females of the same variety as the male and to purebred females of a different variety.

The data in Table 11 show that with respect to fertility of eggs the effects of crossbreeding were variable. On the other hand, in every crossbred mating except one the percentage of fertile and total

Table 11. Effects of Crossbreeding Turkeys on Different Traits
(T. B. Clark, T. D. Runnels, and E. A. Livesay, West Virginia Experiment Station, 1944)

Kind of mating: Males	Kind of mating: Females	Fertile eggs, per cent	Fertile eggs hatched, per cent	Total eggs hatched, per cent	Viability of poults to 4 weeks, per cent
Standardbred Bronze	Standardbred Bronze	79.9	66.1	53.2	83.0
	Bourbon Red	95.0	72.3	68.7	91.2
Bourbon Red	Bourbon Red	94.0	67.1	63.1	92.1
	Standardbred Bronze	88.4	73.2	65.1	87.6
Standardbred Bronze	Standardbred Bronze	89.9	66.8	60.2	98.9
	Broad-breasted Bronze	85.9	64.0	55.3	96.3
Broad-breasted Bronze	Broad-breasted Bronze	71.8	49.3	36.7	95.6
	Standardbred Bronze	89.6	65.8	58.2	100.0
Bourbon Red	Bourbon Red	70.9	62.2	44.7	95.1
	Broad-breasted Bronze	69.1	71.3	49.3	97.9
Broad-breasted Bronze	Broad-breasted Bronze	72.6	50.9	34.8	97.7
	Bourbon Red	90.6	58.9	53.9	97.5

eggs hatched was higher than from the comparable purebred mating. Crossbreeding tends to produce a stimulating effect on hatchability. The results secured suggest that in these matings crossbreeding had little, if any, effect on viability of poults to 4 weeks of age. Turkey breeders should always keep in mind that results from crossbreeding are influenced by the quality of the purebred birds that are crossed.

Crossbreeding tends to stimulate more rapid growth among the poults, as shown in Table 12.

Table 12. Effects of Crossbreeding Turkeys on Growth
(V. S. Asmundson, University of California, 1942)

Kind of mating		Weight of progeny at 28 weeks, pounds	
Males	Females	Males	Females
Black	Black	16.6	9.1
Bourbon Red	Bourbon Red	16.1	10.1
Bourbon Red	Black	19.7	11.0

The data in Table 12 show that the crossbred male and female progeny weighed more at 28 weeks of age than the purebred progeny of each of the two purebred matings. The stimulating effect due to crossbreeding is called "heterosis."

It should be kept in mind, however, that the actual results secured from a particular cross depend to quite an extent on the quality of the purebred birds that are crossed.

In order to carry on crossbreeding work on your own premises, you have to maintain two varieties of turkeys. For most turkey breeders, maintaining two varieties would probably slow up progress in breeding improvement within each variety because there would be fewer progeny in each variety from which to select outstanding toms and hens for future breeding purposes. However, turkey breeders who could maintain two large flocks and several breeding pens of two varieties might practice some crossbreeding. In most cases the crossbred progeny should not be used for breeding purposes.

Deciding on a System of Matings to Make. The first distinction with respect to systems of mating is flock matings versus single-tom pen matings. Flock matings usually consist of from probably 50 up to 150 or more hens mated to several toms. Single-tom pen matings consist of a given number of females that can be accommodated by a single tom, all being confined to a yard or house and kept entirely separate from other turkeys.

Flock Matings. On most farms throughout the country flock matings are maintained. Unfortunately, on all too many of these farms practically no breed improvement program is carried on from year to year. In many cases practically the only attempt to improve the quality of the flock is to exchange toms with a neighbor or purchase a tom from a different breeder each successive year. The size and type of birds in many of these farm flocks usually vary a great deal, since no systematic breeding program is carried on to develop a flock uniform in size, type, and fleshing ability. As a matter of fact, probably the majority of farmers with small-sized turkey flocks rather than attempting to carry on a breeding program of their own would be better off to purchase poults each year from an outstanding breeder or from a hatchery operator who secures his hatching eggs from breeding flocks of superior quality.

Improving the quality of poults secured from flock matings is possible by following a rigid program of selecting breeding stock and a definite system of flock mating each year, especially if you have more than one flock. If you have only one flock and it is of mediocre quality, secure a sufficient number of superior-quality toms two or three years in succession from an outstanding breeder who has a strain noted for rapid growth, good body type and fleshing ability, and good egg production. If you get the right kind of toms, the investment will be repaid in the increased amount of meat secured from the turkeys raised. Thereafter, select the very best toms and hens from your own flock, and if you have about 150 hens in the breeding flock there is not much danger of encountering trouble from too close inbreeding.

If you have two flocks, purchase breeding toms of superior quality from two outstanding breeders, putting the toms from one breeder in one flock and the toms from the other breeder in the other flock. For the second and following years put the very best young toms secured from the first flock with the very best young hens secured from the second flock, and put the very best young toms secured from the second flock with the very best young hens secured from the first flock.

If you maintain four breeding flocks, put the best toms of one strain in flocks one and three and the best toms of the other strain in flocks two and four. Each succeeding year thereafter, put the very best young hens secured from each flock in their dams' pen and put the very best young toms secured from flock one in flock two; those from flock two in flock three; those from flock three in flock four; and those from flock four in flock one.

Single-tom Pen Matings. The primary purpose of making up matings each consisting of one tom and a few hens is to enable you to compare toms from the standpoint of their breeding worth, and the same with hens if you trap-nest them and pedigree-hatch each hen's eggs separately so that you know the sire and dam of every poult. You know that individual birds differ a great deal with respect to the desirable traits you want your whole flock to possess, so you select the very best birds based on your best judgment and anticipate the results, predicting that certain matings will produce much better progeny than other matings. Oftentimes, however, the results are different from those expected. Thereby you have gained a valuable object lesson—you cannot predict the breeding worth of a bird entirely by its outward appearance. But you have done the best you could and are sure to make some progress if you keep on selecting the best birds from the best matings, especially if you have several matings.

Probably four pens is the minimum number of single-tom mating pens you could make up each year with expectations of making marked improvement in quality. With two good strains of turkeys on hand, it is possible to carry on a system of selection and mating so that you would not have to introduce new blood for several years. Number your pens 1, 2, 3, and 4, as indicated in Fig. 19. Select at least four of the best toms and enough of the best hens for two matings from each of the two strains. Hold two of the four best toms selected from each strain in reserve. In pens 1 and 3 put one tom and his

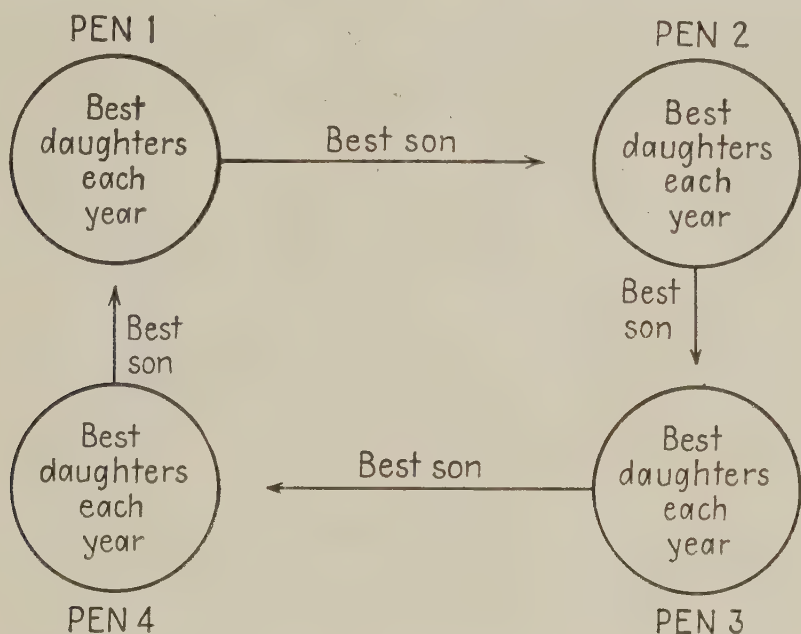


Fig. 19.—Showing annual clockwise rotation of toms secured from single-pen matings, the daughters secured each year from each pen being put in the pen occupied by their dams.

mates from one strain and in pens 2 and 4 put one tom and his mates from the other strain.

Each succeeding year thereafter select the very best daughters from each of the pens and put them in the pen their mothers occupied. Select at least two of the best sons secured from each pen, holding one in reserve. Put one of the sons secured from pen 1 the first year in pen 2 for the second breeding season. Put one of the sons secured from pen 2 the first year in pen 3 for the second breeding season. Put one of the sons secured from pen 3 the first year in pen 4 for the second breeding season. Put one of the sons secured from pen 4 the first year in pen 1 for the second breeding season.

For the third and subsequent breeding seasons follow the same clockwise rotation of the sons secured from each pen the previous breeding season. Such a mating system could be carried on for several years, providing the original matings produced satisfactory results. By selecting at least two outstanding sons from each pen every year, they could be used alternately in their proper pen or the reserve son could be used as a substitute for the son originally put in the pen in case he should give poor results in fertility and hatchability early in the season.

In order to be able to identify the progeny of each pen mating, it would be necessary to toe-punch or wing-band the poults at hatching time. It would also be well to use a definite system of leg-banding the birds in the breeding pens each year, using red celluloid bands for pen 1, white for pen 2, blue for pen 3, and yellow for pen 4. This will help to identify any bird that might get out of its pen.

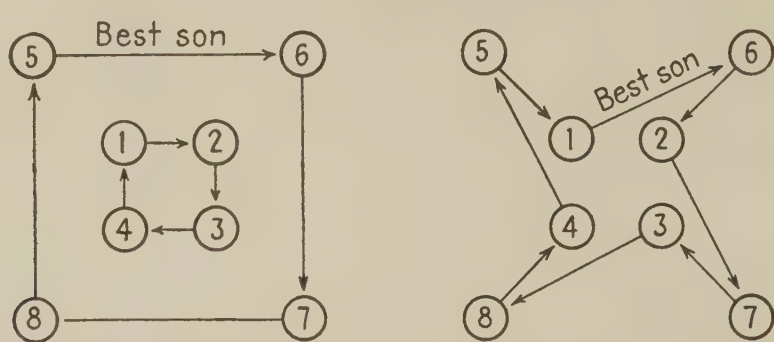


FIG. 20.—Annual clockwise rotation of toms among two groups of four pens each for four years, as indicated at the left. After the fourth year, toms from the four pens of one group are placed with the hens in the four pens of the other group, as indicated on the right.

A turkey breeder who has facilities for maintaining eight single-tom pen matings could follow the system of rotating males shown in Fig. 20. Put different-colored leg bands on the birds in each pen for purposes of ready identification. If you had two good strains of turkeys in your flock, you could start this eight-pen mating system by dividing the very best females of one strain among pens 1, 3, 5, and 7 and the very best females of the other strain among pens 2, 4, 6, and 8. The best daughters secured from each pen each year are put in the same pen that their mothers occupied. In pens 1, 2, 3, and 4 the best sons secured each year could be rotated in the manner suggested in Fig. 19. In pens 5, 6, 7, and 8 the same best-son rotation system could be followed. This system of rotating the best sons secured each year to the next pen within pens 1 to 4 and within pens 5 to 8 is indicated in the left half of Fig. 20. After the fourth year of rotating the best sons within pens 1 to 4 and within pens 5 to 8, the best sons secured from pens 1, 2, 3, and 4 could be put in pens

6, 7, 8, and 5, respectively, and the best sons secured from pens 5, 6, 7, and 8 could be put in pens 1, 2, 3, and 4, respectively, as indicated in the right half of Fig. 20.

In order to carry out this suggested systematic system of rotating the best sons within a group of pens, maintain any number of single-tom mating pens you wish. If you have six pens, you could adopt a 3-3 grouping of the pens and, after the third year of best-son rotation within each group, you could intercross the groups. If you have ten pens, you could use a 5-5 grouping of the pens and after the third or fourth or fifth year of best-son rotation you could intercross the groups.

Here are two rules of real importance to keep in mind in selecting breeding stock. In making the first selection of young toms and young hens for next year's breeding season, select about one-third more toms and hens than will actually be used in order to allow for some culling by the time the matings are made up. Many turkey breeders do not take enough pains in the selection of birds for future breeding purposes. The second important rule is to quarantine birds that have been purchased for 3 weeks before putting them in your flock. The object of this step is to prevent the possible spread of disease.

2. Providing Good Houses or Shelters for Breeders

Put the breeding stock in their breeding pens or shelters about one month before eggs are wanted. The kind of house or shelter to provide depends a great deal upon the section of the country in which you are located. In all parts of the country some provision should be made to protect the eggs from being stolen by predatory animals. Wherever artificial lighting is to be used to stimulate early egg production, a house or shelter of some kind is necessary. The breeding flock should be kept under the control of the caretaker and for this reason use 6-ft. fencing to confine the turkeys within a given area.

When two or more breeding flocks are maintained on the same premises, separate the yards containing the breeders by a vacant yard, to prevent toms in different yards from fighting through the fences and to avoid the possibility of females in one yard being attracted to males in another yard. The breeding yards might be adjacent to each other if separated by a board fence about 4 ft. high topped by 3 ft. of wire fencing. Make the fence dog- and coyote-proof. If turkeys are inclined to fly over the fence, clip all but the two outer primaries of each wing of the hens; do not clip the toms, because this might interfere with mating. To keep turkeys from the top of gates and buildings, stretch 3 ft. of poultry netting on top.

Deciding on Type of Shelter or House. In southern sections of the country where the weather is relatively mild about all that is needed is roosting and nesting equipment, unless the breeders are to be artificially lighted for early egg production.

The roosts should not be over 3 ft. above the ground, so that the birds, especially large toms, will not injure themselves when leaving the roosts. Broad-breasted Bronze breeders require quite low roosts.

FIG. 21.—Open nests 2′ square, 1′ deep, and 18″ above ground are used in Oregon. (*N. L. Bennion, Oregon Agricultural College, 1942.*)

Poles $2\frac{1}{2}$ by 5 in. in diameter may be used for roosts although $2'' \times 4''$ studding with the 4-in. side up and the top corners rounded off is better. If built on skids they can be moved readily. Provide about one linear foot roosting space per bird. Put wire flooring under roosts to keep turkeys out of droppings.

Barrels may be used for nests, although several turkeys are apt to crowd into one barrel and break some eggs. A better arrangement is to provide boxlike nests each 2 ft. square and 1 ft. deep, the bottom of the nests being about 18 in. above the ground, as shown in Fig. 21. A very satisfactory type of nest is shown in Fig. 22. Figure 23 shows range shelters drawn together and equipped for artificially lighting the breeders, a satisfactory arrangement in sections where winter climate is mild.

Fig. 22.—Each nest has two slat "doors." When one door is horizontal, as in the case of the first and fourth nests from the right, a hen may enter the nest by pushing the other door inwards and upwards. The other door then prevents another hen from entering the nest, as in the second and fifth nests. The hen on the nest can leave after having laid, by pushing the outer door upward. (*Turkey World.*)

Fig. 23.—Roosting shelters placed side by side, equipped with artificial lights to stimulate early egg production. (*N. L. Bennion, Oregon Agricultural College, 1942.*)

In northern sections of the country, severe snowstorms may smother some of the birds and feed hoppers may be buried in snow unless adequate shelters or houses of some kind are provided for the birds and feeding equipment. Shelters may be of a temporary nature, constructed of bales of straw as shown in Fig. 24, but it is much better to have a well-built house properly equipped with roosts and nests. Put 1- or 1½-in. gauge wire over the front opening of the house.

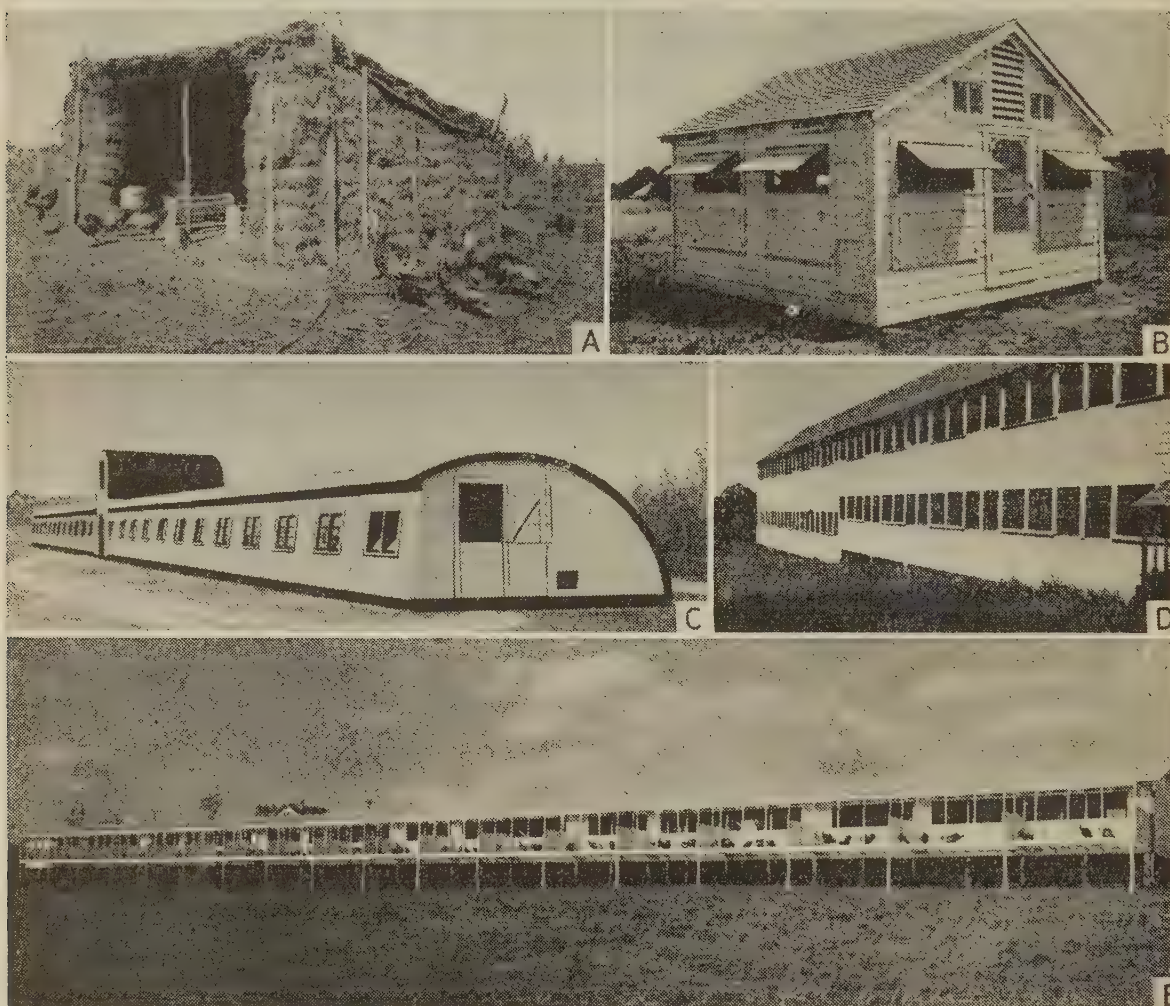


Fig. 24.—Houses for breeders. *A*, a house built of bales of straw. (*T. T. Milby, Oklahoma Experiment Station.*) *B*, a well-ventilated house for warm sections of the country. (*J. N. Thompson, Texas Experiment Station.*) *C*, a 16′ x 240′ breeding house at Kalona Turkey Cooperative, Iowa. (*National Ideal Company.*) *D*, a long two-story breeding house in New Hampshire. (*Peter C. Crafts, Rosmoore Farms, N. H.*) *E*, an 18-pen house with porch attached: there is an alleyway at the rear with a door every second pen to avoid drafts. (*Chas. W. Wampler, Va.*)

Confining Breeders. For single-tom pen matings, provide about 10 to 15 sq. ft. of floor space per bird, depending upon the size of birds, providing the birds have access to a yard or sun porch as large as or larger than the house. For instance, a house 12′ × 12′ would accommodate 15 Beltsville Small-type Whites or 11 Broad-breasted Bronze and the yard or sun porch should provide as much or more space. Put the roosts on supports tilted at an angle of about 15 degrees, the front roost being about 2 ft. above the floor and the back roost at least 18 in. from the wall. Allow 2 ft. from center to center of roosts and provide one linear foot roosting space per bird. To prevent the birds getting into the droppings and laying eggs under the roosts, put 2-in. square mesh wire of 18 gauge around the space below the roosts and put wire immediately under the roosts or 1″ × 1″ pieces 3 in. apart, from center to center, between the roosts. At least 8 trap nests are necessary for 14 hens. Put wire platforms under the hoppers and waterers to keep the house as sanitary as possible.

A 20′ × 20′ house will accommodate from 35 to 40 birds, depending upon their size. Many large operators use long houses divided into pens, some of them being equipped with sun porches and others not; in the latter the birds are confined throughout the breeding season. The eggs laid by breeding stock kept in sun porches without a house are usually very poor in fertility.

For each breeding house, provide double yards. Alternately yarding the pen or flock of breeders every week or so helps to avoid contaminating soil with blackhead organisms. Adequate shade for breeding stock in hot weather is very important.

3. Breeding for Good Body Type and Fleshing

As a turkey breeder your primary objective should be to develop strains of turkeys that produce the most meat on the least feed in the shortest time.

You must have a rapid-growing strain of turkeys for the most efficient conversion of feed into meat. Progeny of large-sized breeding stock tend to grow more rapidly than progeny of small-sized breeding stock. It has been pointed out previously that males grow faster than females. In most strains maximum weight in males is usually attained at about 11 months and in females at about 10 months. At about 24 to 28 weeks of age females weigh about two-thirds as much as males.

Selecting Rapid-growing Poults for Breeding. In order to develop a rapid-growing strain, go over your poults each year at about 16 weeks of age and select for future breeding purposes the best developed males and females, providing they are otherwise desirable in body conformation. Select at least one-third more than will eventually be used. Later in the season, but before any birds are marketed, go over the selected birds and save only the best. The size of bird to be kept for breeding purposes depends, of course, upon the approximate size of market bird you wish to produce according to the variety of turkey you keep. Reject all late-maturing birds. If you are trap-nesting breeding hens and carrying on pedigree-breeding work with single-tom matings, be sure to select prospective breeders on a family basis.

Desirable Weights at Selection Time. Regardless of the variety kept, try to develop a flock in which the males and females, respectively, are relatively uniform in size. Since the selection of prospective breeders from among the poults raised each year should be done before any of them are marketed, young toms and young hens selected at about 24 weeks of age should have attained the weights given in Table 13.

A minimum weight for toms and hens should be set, birds weighing less than the minimum being rejected as future breeders. Do not keep any tom that fails to weigh within 3 lb. and do not keep any hen that fails to weigh within 1 lb. of the variety and sex weight given in Table 13. Uniformity of size among toms and among hens is very desirable, so be cautious about keeping excessively large toms or hens.

Table 13. Desirable Weights at 24 Weeks for Selecting Future Breeders

Variety	Approximate weight at about 24 weeks of age, pounds	
	Males	Females
Broad-breasted Bronze	24.0	15.0
Standardbred Bronze	20.0	13.0
White Holland	19.0	12.0
Black, Bourbon Red, Narragansett	18.0	11.0
Beltsville Small-type White	16.0	10.0

In any variety, it is a mistake to use an excessively large young tom as a breeder in relation to the size of the young hens to which he is mated.

Weighing turkeys is quite a problem, and everything possible should be done to lighten the work. Figure 25 shows a chute and shed used for catching the birds. As they are weighed they should be judged for body conformation and breast fleshing. Before this is done, however, drive your flock or a part of it into a corral or enclosure where you can pick out what you think are the best birds as they stand or walk around in the enclosure. Pick out at least one-third more of the best birds than you need for next year's breeding season and band them. These are the ones to be examined carefully and graded on the basis of body conformation and breast fleshing after they have been weighed. A turkey breeder trap-nesting his hens and pedigree-hatching his poults should weigh and grade all the progeny of his single-tom pen matings.

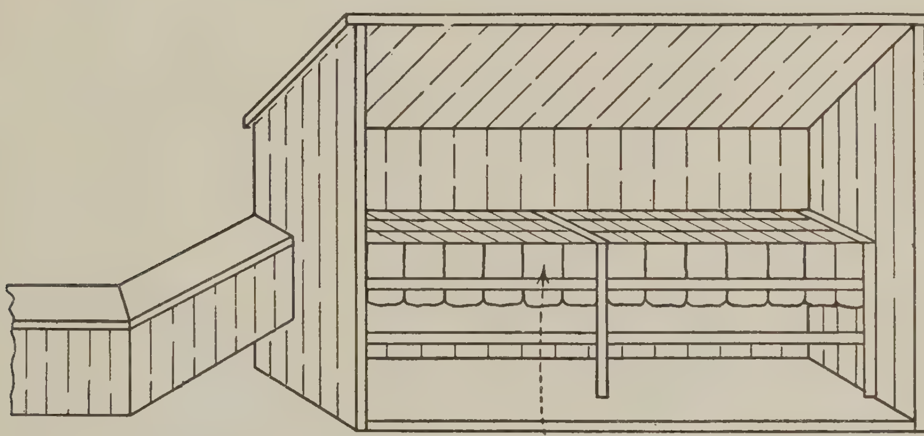


Fig. 25.—Chute at left for driving turkey sinto catching shed, where they are easily caught without being disturbed and much time and labor are saved. Turkeys are driven through incline chute into slat-floored coop inside of shed, the bottom of the coop being about 3 ft. above floor of shed to make it easy to remove birds from coop by grasping their feet. Burlap bags hanging over front of coop prevent turkeys from seeing the person as he approaches the coop to catch a turkey. (*L. E. Cline, Nevada Extension Service*, 1944)

Rejecting Birds with Abnormalities. Do not save for breeding purposes any poults with the serious defects and disqualifications mentioned in Chap. 1. Also, do not save any young toms and hens that possess deformities or other abnormalities, because some of them may be inherited. These objectionable characteristics include crooked keels, calluses on the keel bone, deformed beaks, crooked toes, deformed feet, deformed backs, and pendulous crops. If abnormalities are prevalent in certain families, it would be well to reject the entire family.

Selecting for Good Conformation and Fleshing. The type of body in turkeys, in addition to the amount of fleshing over the breast and on the thighs, has a marked influence on consumer acceptance when the birds are dressed for market. A well-proportioned body usually gives a dressed bird a plumper appearance than a poorly proportioned body even though both carcasses may have the same amount of meat. A visit to almost any dressed-turkey market will convince you of the great variability in body type among birds of the same weight. In almost every flock of live birds there is apt to be considerable variability of body type among the toms and among the hens. As a turkey breeder, try to develop a flock that is as uniform as possible in body type.

During recent years a few turkey breeders have made good progress in breeding for uniformity of body type or conformation. They have used measuring calipers to measure the width and depth of body, length of keel, and length of shank. They have selected for future breeding purposes young toms and hens having relatively broad and deep bodies with good length of keel and relatively short shanks.

The data in Table 14 have been used by some turkey breeders as a guide in the selection of young toms and hens to be used as breeders with a view toward developing strains uniform in body type.

TABLE 14. MEASUREMENTS TO BE USED AS A GUIDE IN SELECTING FOR DESIRABLE CONFORMATION IN BREEDING STOCK

(T. T. Milby, R. G. Jaap, and R. B. Thompson, Oklahoma Experiment Station, 1942)

* Males, 28 weeks of age				* Females, 24 weeks of age			
Weight, pounds	Maximum shank length, inches	Minimum keel length, inches	Maximum body depth, inches	Weight, pounds	Maximum shank length, inches	Minimum keel length, inches	Maximum body depth, inches
15	7.0	6.7	8.2	8	5.4	5.3	6.1
16	7.1	6.8	8.4				
17	7.3	7.0	8.5	9	5.7	5.5	6.4
18	7.4	7.1	8.7				
19	7.5	7.2	8.9	10	5.9	5.7	6.6
20	7.7	7.3	9.0	11	6.0	5.9	6.8
21	7.8	7.5	9.2				
22	7.9	7.6	9.3	12	6.2	6.0	7.0
23	8.1	7.7	9.4	13	6.4	6.2	7.2
24	8.2	7.8	9.6				
25	8.3	7.9	9.7	14	6.5	6.3	7.3

* Note: These measurements are applicable only to turkeys at or before the ages specified.

In selecting prospective breeders according to the measurements given in Table 14, weigh each bird in a hanging position and measure the depth of body from the anterior point of the keel to the shoulders just behind the wing joints. Then lay the bird on its left side and measure the length of the right shank after bending it at right angles to the thigh and measure the distance from the outside of the hock joint to the bottom of the foot beside the sole pad. The length of the keel is measured while the bird is still lying on its side. The data in Table 14 are arranged so that birds of different sizes may be compared. Birds conforming to the measurements given have the same relative body shape, regardless of size. Selecting breeders on the basis of these measurements will help considerably in developing a flock uniform in conformation, especially if selection is made on a family basis.

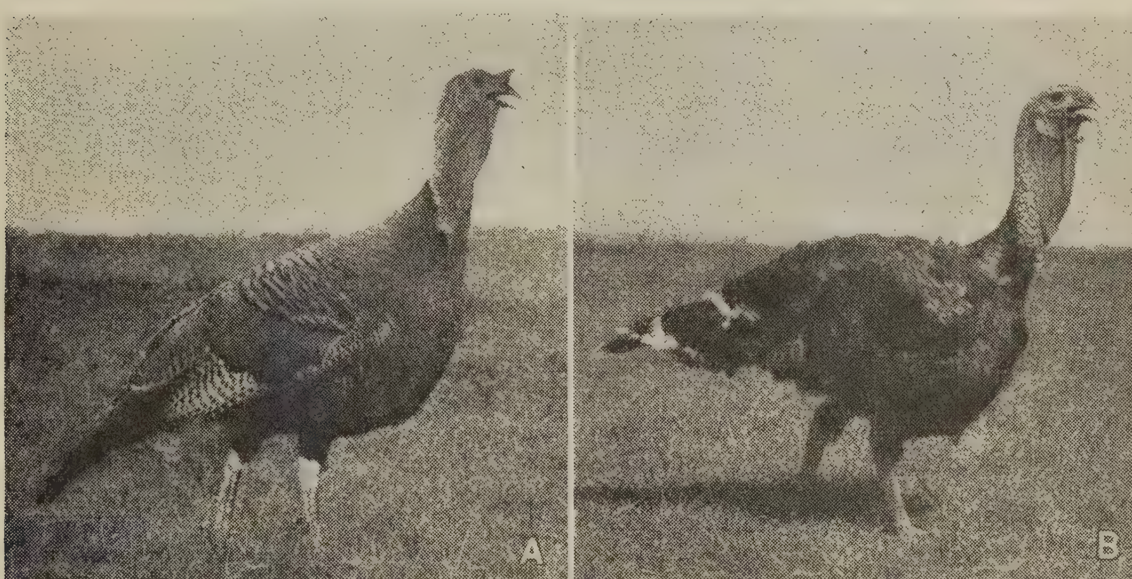


FIG. 26.—*A*, a well-balanced tom with well-fleshed breast but with keel parallel with back. This is the type of bird to select for breeding purposes. *B*, a tom too heavy in front. A bird of this conformation walks awkwardly, frequently has difficulty in mating, and often gives poor fertility. (*J. N. Thompson*, *Texas Experiment Station.*)

Besides having rather definite proportions with respect to length of shank and keel and depth of body in the poults you select for future breeding purposes, each bird must be well "balanced." The legs should be placed squarely under the body. In some birds the legs are so far back on the body that the bird tilts forward when walking, as shown in Fig. 26*B* (see also Fig. 27, top, and Fig. 28, *C*). Do not keep these birds for breeding purposes. A bird with a "rocker" keel, shown in Fig. 27, center, is undesirable and should not be used as a breeder. Good length of keel in relation to depth of body and keel parallel with the back are desirable, as shown in Fig. 27 bottom, (see also Fig. 28*A*). A keel parallel with the body gives the dressed bird a good appearance.

In addition to uniformity in body conformation in your flock, you want each bird to have an abundance of fleshing over the breast and on the thighs at time of marketing. Width of breast is apparently the most important single factor determining the amount of fleshing

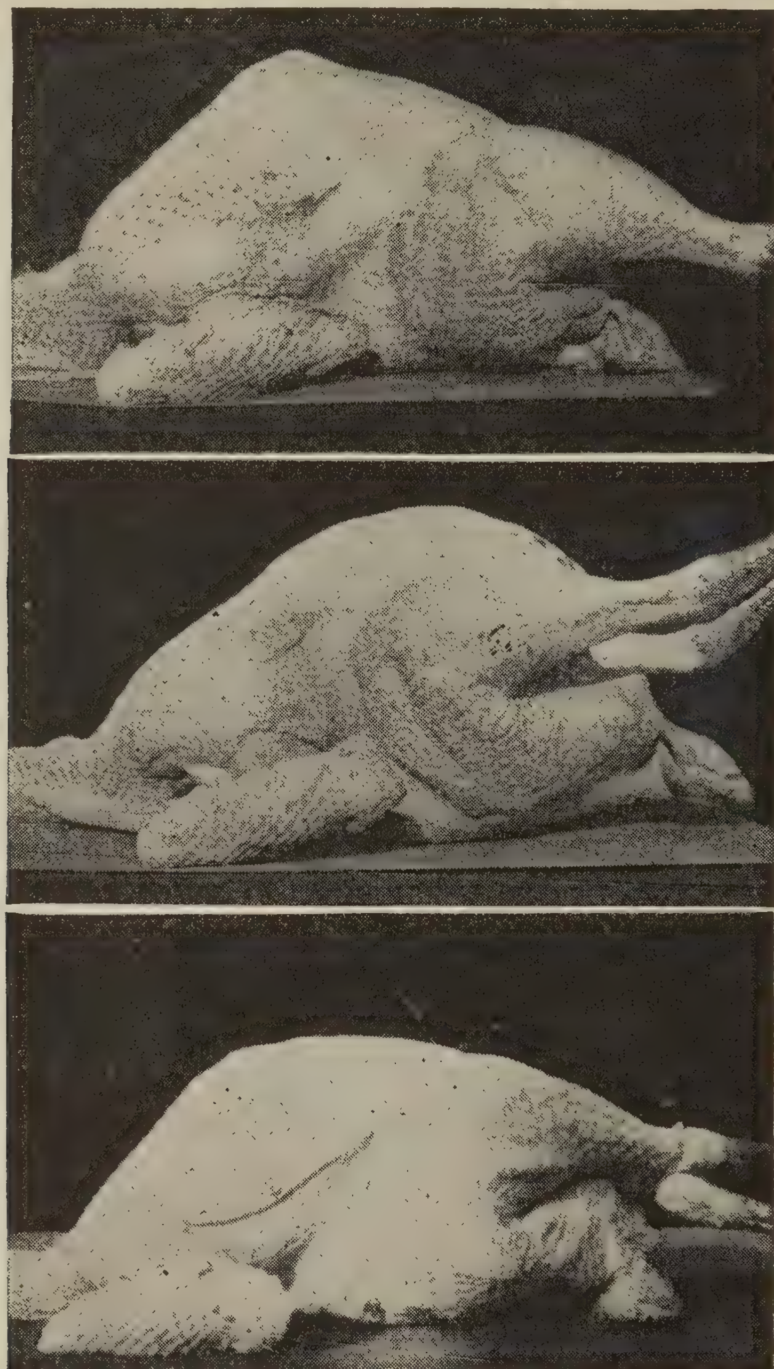


Fig. 27.—Showing three distinctly different body types. Top, a bird too heavy in front, keel not parallel with back, and legs set too far back. Center, a bird with a "rocker" keel and lacking full breast development. Bottom, a well-proportioned bird with well-fleshed breast and keel parallel with back. (*J. N. Thompson, Texas Experiment Station.*)

over the breast and the appearance of dressed birds from the consumers' standpoint.

It is possible to develop a strain excelling in breast fleshing without measuring breast width of the prospective breeders with calipers. Figure 29 shows how to estimate the degree of fleshing over the breast by the "feel" of the hand. This method has the advantage of enabling one to estimate the relative amount of fleshing over all the breast from front to rear. Turkeys are sometimes well fleshed over the fore part of the breast but poorly fleshed over the rear portion. This is because the breast musculature narrows rapidly from front to rear, producing a pronounced inverted V-shaped breast that does not have good consumer appeal.

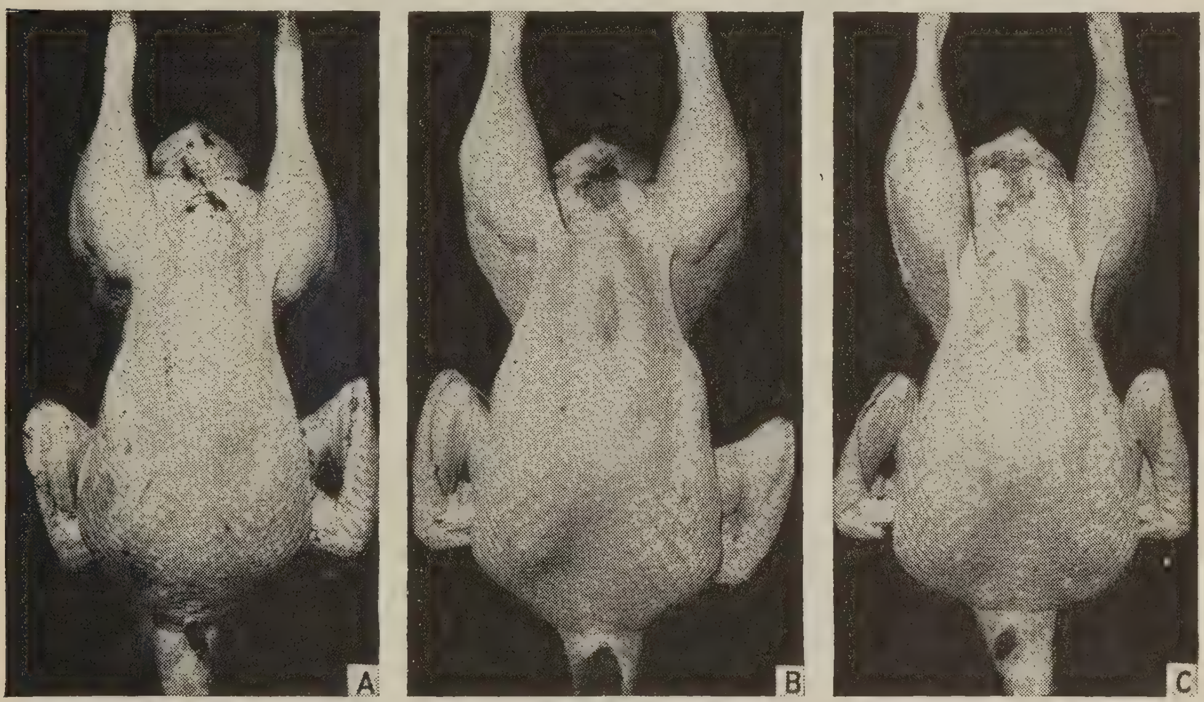


Fig. 28.—*A*, a bird with full breast development and good length of keel, which is covered with flesh over its entire length. *B*, a bird very heavy in front but fleshing over the keel tapers off toward the posterior end. *C*, a bird very heavy in front and with a short keel. (*J. N. Thompson, Texas Experiment Station.*)

In order to estimate breast fleshing by hand, get an assistant to hold each turkey in his lap with the turkey's breast up and its head toward you. Part the breast feathers and run your hand over the breast and estimate the amount of fleshing. You will find it a great help in selecting your prospective breeders if you classify your turkeys into three grades. For breeders, keep only the birds that qualify as "broad," unless you are obliged to use some grading "medium" to give you the number of breeders you require.

Some investigators at different agricultural colleges have explored the possibility of improving strains of turkeys with respect to fleshing over the breast by making certain specific measurements of width of breast. In selecting prospective breeders from among the poults, breast width is measured at about 2 in. back of the anterior point of the keel and about 3 in. from the apex of the keel. Selecting poults for breeders every year on the basis of width of breast will do much to develop a strain of turkeys noted for good fleshing over the breasts, if the proper procedure is followed.

One method is on the basis of "breast area" determined by placing each turkey on its back on a table and laying a No. 12 fuse wire over

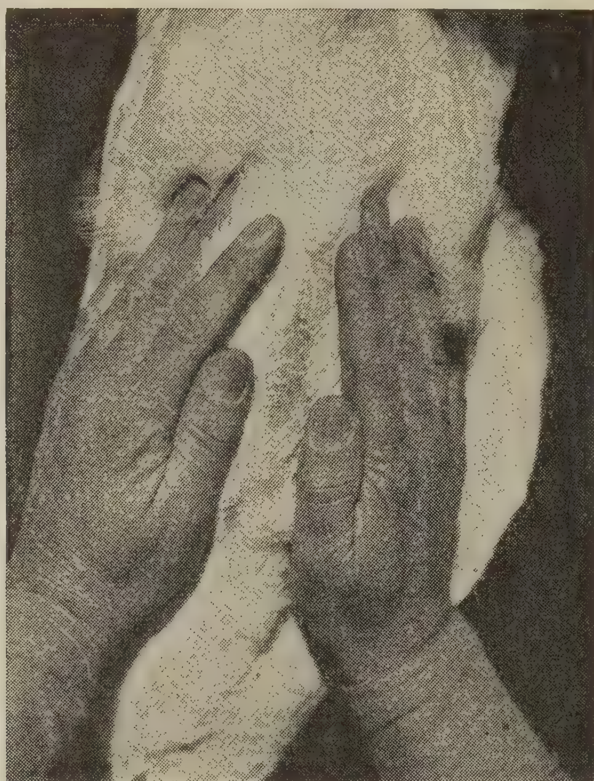


FIG. 29.—Showing method of selecting future breeding stock from among the young turkeys raised each year by "feeling" with the palms of the hands the fleshing over the breast, as well as the length of keel. If selection is made on a family basis for a few years, you could probably do much to improve the market quality of your turkeys. (*C. W. Knox and S. J. Marsden, Bureau of Animal Industry, U.S. Department of Agriculture.*)

the keel, near the front, and down each side of the breast to a distance of at least 3 in. Having shaped the fuse wire to the breast, remove the wire carefully and place on a sheet of paper and trace with a pencil. Draw a straight line across the paper 3 in. below the apex of the fuse outline of breast shape. The area of the shape of the breast is determined in square inches by using a planimeter. Figure 30 shows the cross section of two birds whose area of breast was determined.

The area of the breast of the bird on the left was only 5.8 sq. in., whereas the area of the bird on the right was 13.7 sq. in. The dressed weight of the bird on the left was 16¼ lb. and the breast meat weighed 3 lb. 3 oz., or 26.8 per cent of the drawn weight. The dressed weight of the bird on the right was 17⅝ lb. and the breast meat was slightly over 4 lb., or 31.0 per cent of the drawn weight.

Determining breast area is time-consuming and is rather involved, and it is doubtful if the method will be used extensively by turkey breeders.

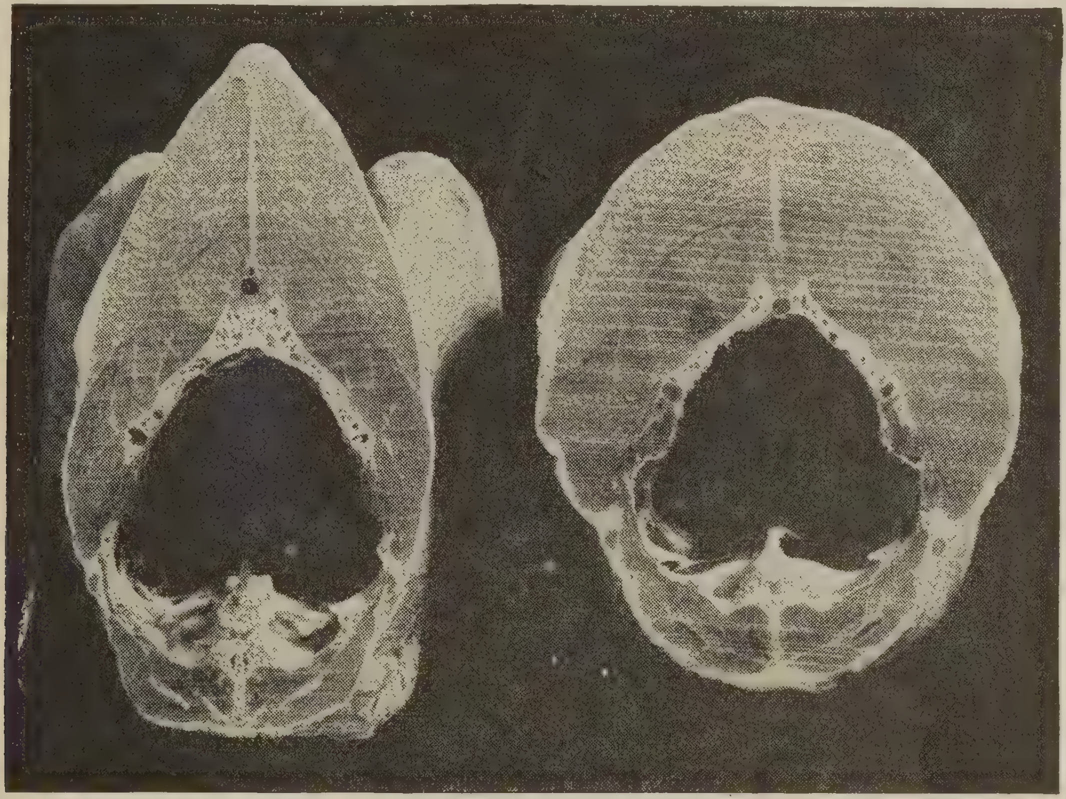


FIG. 30.—Cross-section views of two birds differing markedly in breast area, which is influenced by body shape and the extent of the development of muscles over the breast. The bird on the right is the kind of dressed turkey preferred by consumers. (*L. F. Payne, Kansas Agricultural College*, 1944.)

Several investigators studying body conformation, including the degree of fleshing over the breast, have used calipers, such as shown in Fig. 31*A*. Large calipers are used for measuring length of shank, length of keel, and depth and width of body, while small calipers are used for measuring width of breast. Knowledge gained from these studies has been of considerable value in the development of a selection program to provide superior strains of market turkeys. At the same time, taking several measurements on each bird requires time and may not be practical for most turkey breeders.

The measuring instrument shown in Fig. 31*B*, makes it possible to determine the relative degree of roundness of breast in precise numerical terms with a minimum of labor. This instrument was made for the purpose of determining breast width at a level of one-fifth of the total body depth and, therefore, measures breast width in relation to body depth. A bird is placed flat on its back with its backbone along the line in the base and with the medium line through its keel under the end of the upper arm, the distance *x* measuring

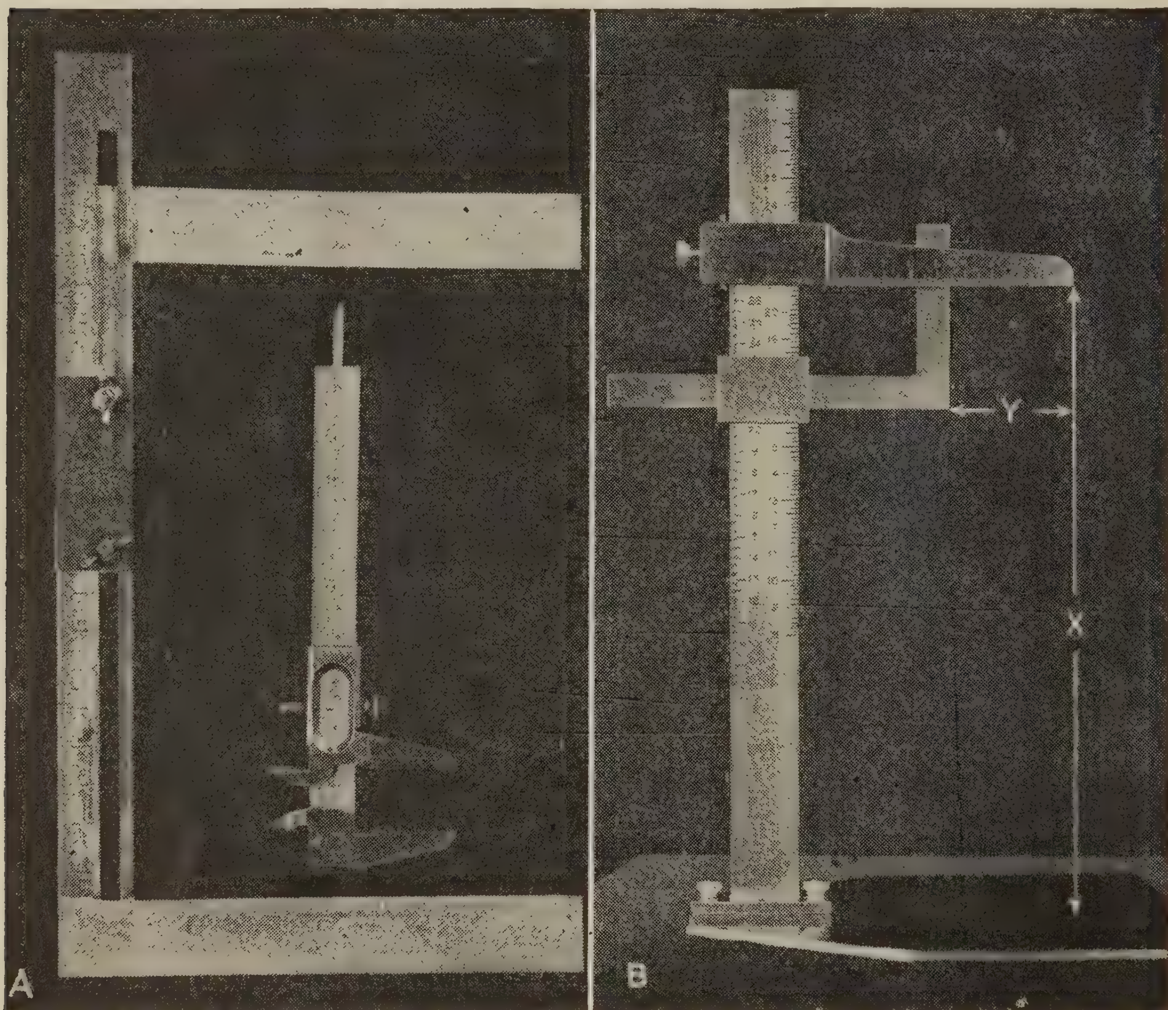


FIG. 31.—*A*, the larger calipers are used for measuring shank length, keel length, and depth and width of body; the short calipers are used for measuring breast width. (*University of Maryland.*) *B*, a measuring instrument for determining quite quickly the width of breast in relation to body depth. Such an instrument should be of considerable practical value to turkey breeders, especially when applied to the selection of young stock on a family basis for future breeding purposes. (*S. Bird*, *Central Experiment Farm*, *Ottawa*, *Canada.*)

body depth. The depth determined for each bird is read off the right-hand scale on the upright and at the top of the glider because the scale is offset by the height of the glider. With the bird still held in position, move the rectangular finger into such a position that the top of its glider is at the numerical reading on the left-hand scale on the upright equivalent to the bird's full depth as shown on the right-hand scale on the upright. The left-hand scale is four-fifths the natural scale and is offset by the height from the point of angle to the top of the glider, so that the point of the finger's angle is one-fifth the depth below the point of the upper arm. Therefore, when the point of the finger touches the breast of the bird, the distance y measures half the total breast width at a level one-fifth the body depth from the keel.

If hens are trap-nested in single-tom matings and pedigree-breeding work carried on so that you know the sire and dam of every poult raised, you can make good progress in a few years in improving the fleshing quality of your strain. When judging your poults for breast fleshing, see if certain families of full brothers and sisters are superior to most other families of full sisters and brothers. Future breeders should be selected from the superior families. Furthermore, if several full-sister dams used in one or more of your matings each produced superior progeny with respect to breast fleshing, you can be certain that the sons and daughters of these full-sister dams are the ones from which you should select future breeders. Also, see if the poults produced by certain sires are superior on the average to the poults produced by other sires. Select future breeders from the best full-brother-and-sister families produced by the best sires.

By concentrating your selection of future breeders from among the progeny of the dams and sires that proved to be the best breeders you are certain to make more progress in developing a strain of turkeys noted for good breast fleshing than by selecting the best poults regardless of their ancestry.

Above all, always keep in mind that the shape of the breast and the amount of fleshing over the breast and on the thighs are factors that affect consumer appeal when dressed turkeys are offered for sale.

4. Breeding for Good Egg Production

Good egg production is necessary in order to produce hatching eggs or poults economically. The higher the egg production during the breeding season, the lower the feed cost of each dozen eggs produced. This is important because the cost of feed represents about 35 to 40 per cent of the total cost of producing eggs.

Egg production in turkeys is inherited. The conditions under which turkeys are kept, the kind of diet fed, and other factors affect the number of eggs laid, but even when all birds in a flock receive the same treatment some lay poorly and some lay well. By adopting a program of selecting the right kind of breeders, the egg-laying ability of almost any flock can be improved.

Using Artificial Lights to Stimulate Early Production. Many flocks of turkeys start laying so late in the spring that it is practically impossible to have the poults in well-finished market condition for the Thanksgiving market. During recent years the demand for

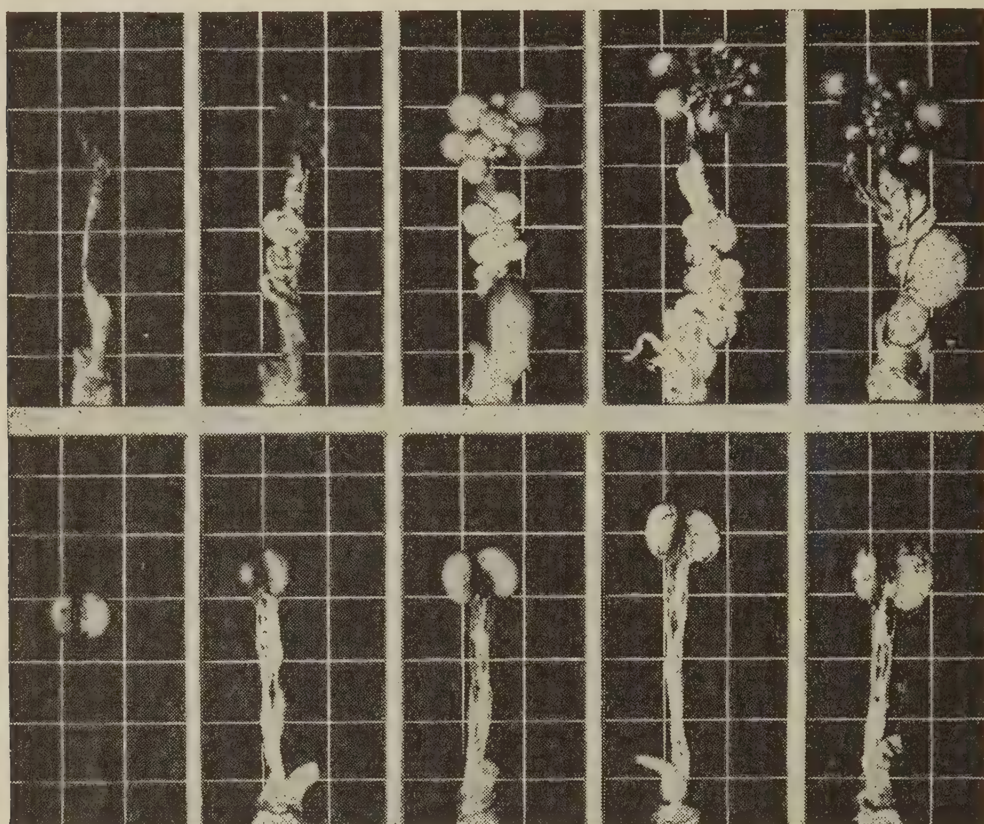


FIG. 32.—Showing the stimulating effects of artificial illumination on the development of the reproductive organs of the turkey; female ovary and oviduct above and male reproductive organs below. (*Pennsylvania State College.*)

hatching eggs during February and March has been on the increase so that it is desirable to have the birds in good laying condition by the latter part of January or even earlier. Artificially lighting the turkeys, especially in the northern latitudes, is an efficient way of stimulating early laying.

Figure 32 shows the extent to which the reproductive organs of females and males are stimulated by artificial illumination. Figure 33 shows that hens given artificial lighting beginning Dec. 1 started to lay Dec. 30 and were laying well by the middle of January, whereas other hens of the same breeding but not lighted did not start laying until March 1 and were not laying well until the latter part of March.

Since the ovary and oviduct of the female respond more quickly to the influence of artificial lighting than the reproductive organs of the male, it is necessary to put males under lights about one to three weeks earlier than females in order to secure good fertility by the time

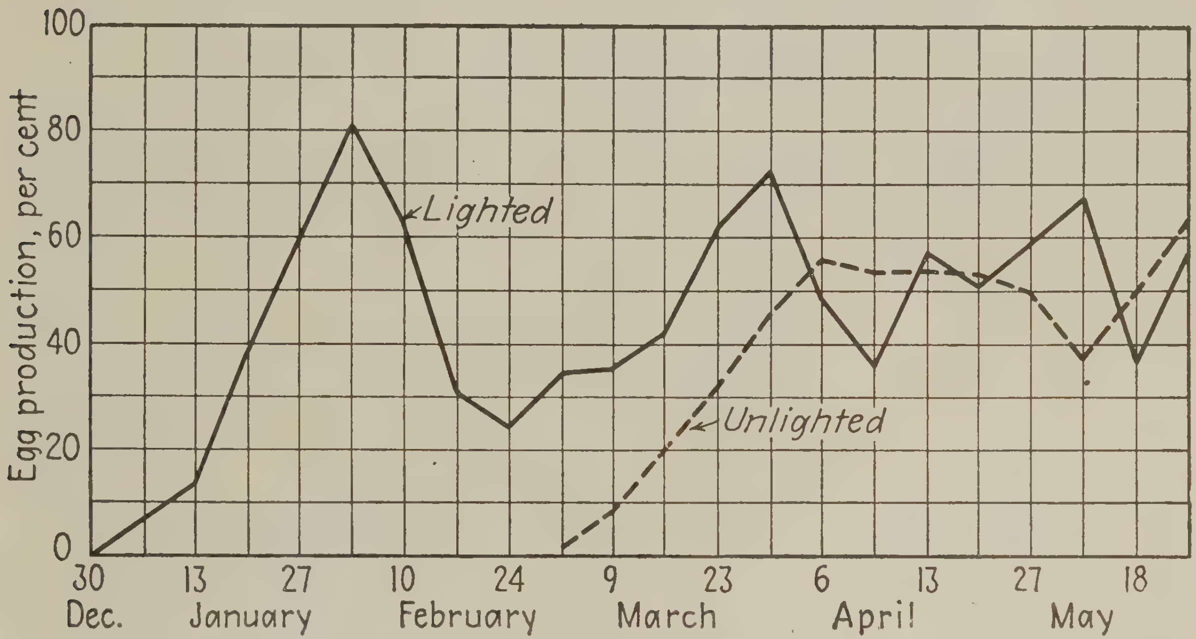


FIG. 33.—One group of Narragansett hens was lighted beginning December 1; during December and January lights were turned on at 4:30 A.M., and beginning February 1 lighting was reduced 15 min. weekly until April 1 and then discontinued. Another group of Narragansett hens was not lighted. Artificial lighting stimulated egg production. (*H. M. Scott and L. F. Payne, Kansas Agricultural College*, 1937.)

the females are laying well. The following table will serve as a guide for the time to start lighting females according to the time you want your flock to be in good production and the time to start lighting males to secure good fertility.

Approximate time good production wanted	Jan. 1	Feb. 1	Mar. 1
Approximate time to start lighting females*	Nov. 25	Dec. 25	Feb. 1
Approximate time to start lighting males*	Nov. 1	Dec. 5	Jan. 15

* Dates suggested by P. H. Margolf for latitude of Pennsylvania and north. For more southerly latitudes approximate dates might be a little later. As a matter of fact, some results have been secured indicating that in southern sections of the country it may not be necessary to light males before females are lighted.

Start giving lights to females gradually, the first day turning the lights on ½ hr. before daylight and each succeeding day 15 min. earlier until you reach 4:30 A.M., or early enough in the morning to give your breeders about 13 hr. of artificial light and daylight combined. A 25-watt or 40-watt lamp with a reflector is sufficient to light an area of 100 sq. ft. Protect the lighting equipment against damage, such as a flying turkey.

Feed and water, the latter kept from freezing in winter by the use of electrical heaters, should be available when the lights come on. A comfortable house or shelter will ensure good fertility if you have the right kind of breeding stock.

In Fig. 34*A* are given records of the average egg production per bird to May 31 of Bourbon Red and Standardbred Bronze hens not given artificial lighting. These data do not mean that Standardbred

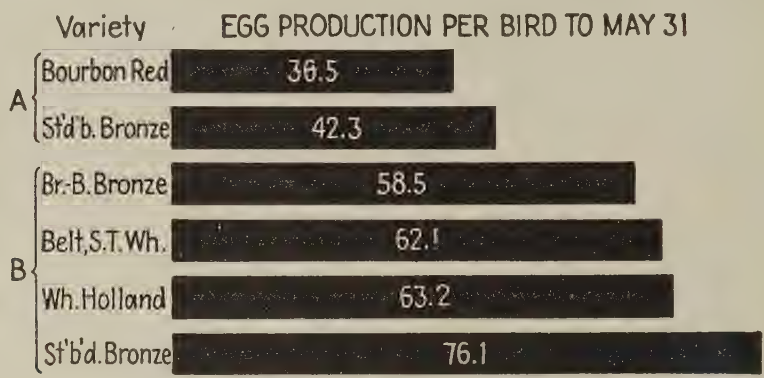


FIG. 34.—Comparison of egg production by varieties and between nonlighted and lighted groups. *A*, average egg production per bird in two varieties from the time laying commenced to May 31 not lighted. These averages show the need for improved breeding to increase production. (*T. B. Clark, T. D. Runnels, and E. A. Livesay, West Virginia Evperiment Station*, 1940.) *B*, average egg production per bird in four varieties to May 31, artificially lighted beginning January 15. Although artificial lighting stimulates early egg production, there is still need to improve the laying ability of practically all flocks in order to reduce the cost of producing hatching eggs and poults. (*D. Whitson, S. J. Marsden, and H. W. Titus, Bureau of Animal Industry, U.S. Department of Agriculture*, 1944.)

Bronze always lay better than Bourbon Reds. In this case this particular strain of Bronze laid better than this particular strain of Bourbon Reds. At some other place the position of the varieties might be reversed.

In Fig. 34*B* are given records of the average egg production per bird to May 31 of four varieties given artificial lighting. Again the record of egg production of each variety is not an index of the laying ability of all birds belonging to that variety. The principal point to note in comparing the data in Figs. 34*A* and 34*B* is that artificial lighting stimulated egg production.

Identifying the Best Layers. The first step in breeding for good egg production is to identify the best layers. This can be done by using trap nests. Provide at least eight trap nests for a pen of 14 hens. Trap nests may be located under the droppings board or placed along the inside wall of the house, or on the outside, as shown in Fig. 35.

If the trap nests are not located under the droppings boards, make the roof of the nest quite steep to give the birds more head room and to prevent them from roosting on top. Some turkey breeders prefer to have a hinged door as part of the sloping top because it is much easier to lift the turkey out of the nest through this door than remove her through the trap door (see Fig. 36).

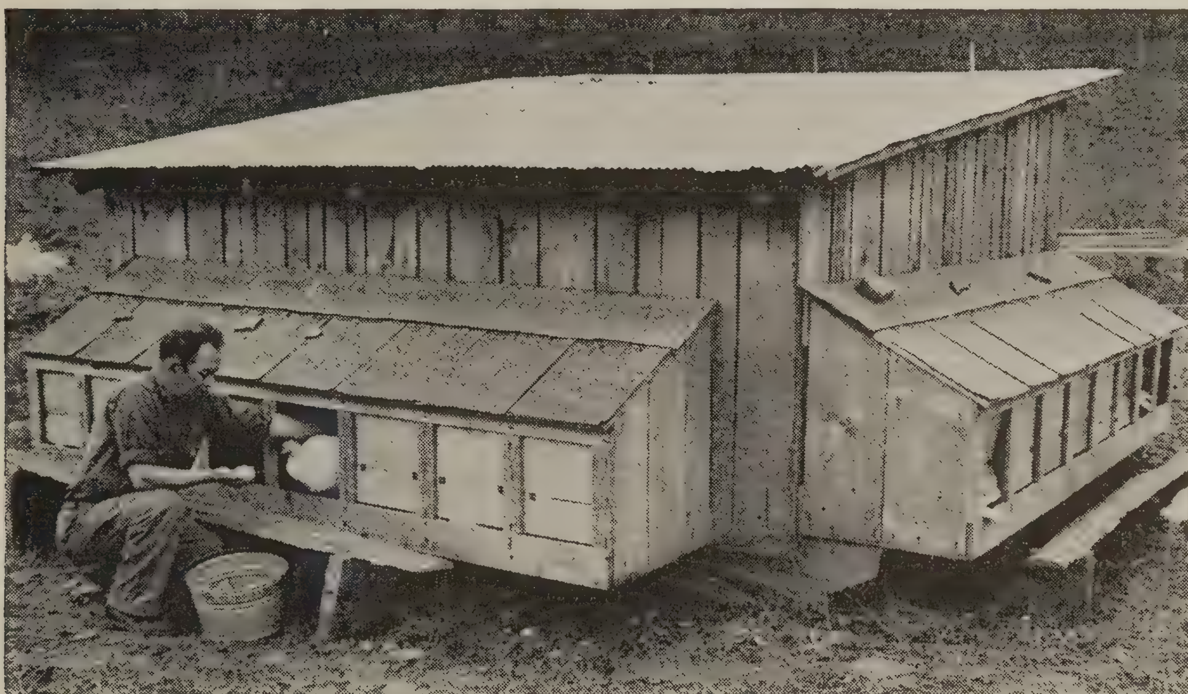


FIG. 35.—Trap nests for turkeys on farm of Wilmer Claar, Bedford County, Pa. (*H. H. Kauffman, Pennsylvania Extension Service.*)

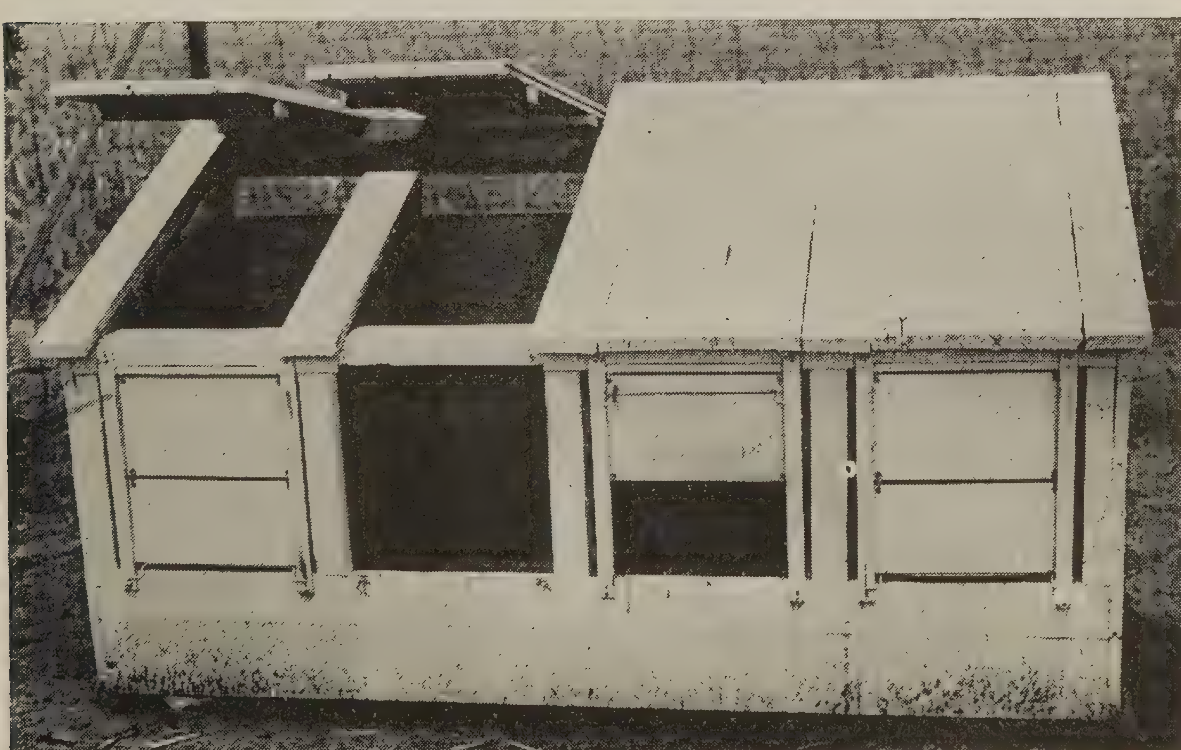


FIG. 36.—Trap nests with hinged tops. (*Kansas Agricultural College.*)

In sections of the country where the weather is quite warm during the breeding season, slats or wire netting over part of the back and forming the upper parts of partitions is desirable to prevent birds from becoming overheated. Even so, during hot spells remove birds from the nests promptly.

Visit the nests frequently, especially in the morning, and as a layer is released from the nest mark her egg with its proper number, which she should carry on her leg band. Instead of having to lift the turkey to look at her leg band, it is much simpler to paint the leg-band number on the saddle she wears, as shown in Fig. 37. Saddles are

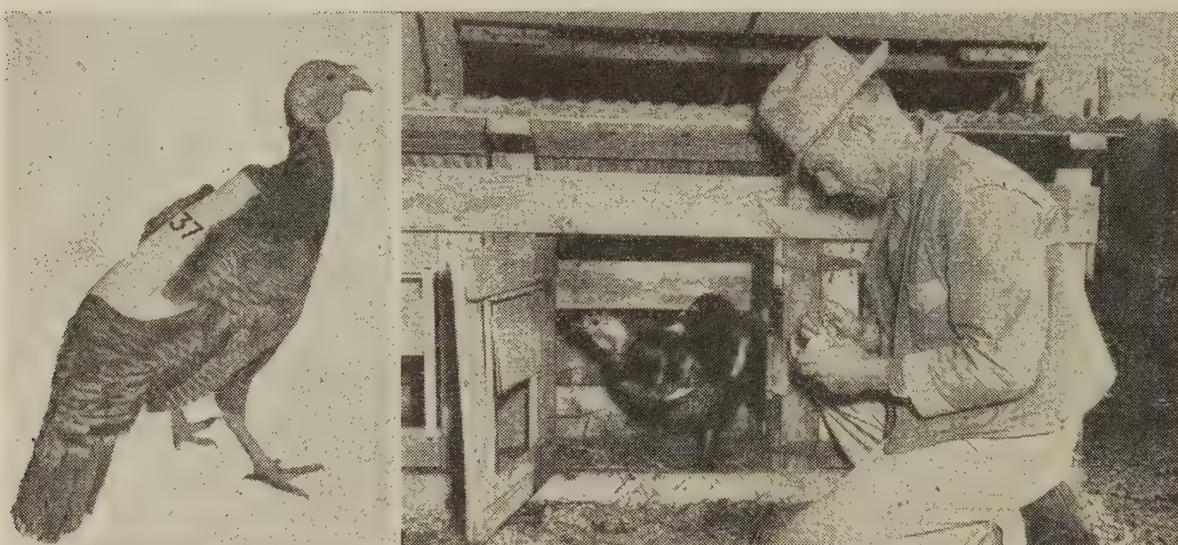


Fig. 37.—Left, hen with saddle on which has been painted the hen's leg-band number. (*California Agricultural College.*) Right, Ray E. Janes trapping turkeys by opening the trap door to let the turkey walk out, at which time he writes the number on the saddle on the hen's egg. (*Turkey World.*)

very desirable to prevent females from being injured by heavy and awkward males. Protecting the females' backs not only tends to ensure better fertility but also avoids a "blue-back" condition in the dressed carcass when the breeders are marketed. Painting the leg-band numbers on the saddles eliminates much unnecessary work in releasing a bird from the trap nest. Retain her leg band, however, because she might lose her saddle and you will want to refer to the leg-band or wing-band number or both after the saddles are removed at the completion of the breeding season. Mark the bird's number on the small end of the egg so that it will still be visible at hatching time, when it may serve a good purpose in checking records. If the number is placed on the large end of the egg, you can rarely use it as a check on the number of poults hatched from each hen because in emerging from the shell the poult pips around the large end. Besides putting the number on the small end of the egg also put the pen number and the date.

Keeping a Record of Egg Production. Keeping individual records of egg production by months enables you to compare the laying ability of all hens trap-nested. You have a record telling you which hens started to lay earlier than others, which hens did not stop laying for several days whether because of broodiness or otherwise, how many times any of the hens became broody, and which hens laid at the best rate. You can also compare the average egg production of each group of full sisters, which will give you valuable information concerning the families from which future breeders should be selected. This is particularly important with respect to the selection of males for future breeding purposes.

Selecting Breeders to Develop a Better Laying Strain. Having identified the best layers in your flock, the next problem is to decide from which toms and hens you should select poults to be used as breeders the next breeding season. The individual records of egg production that you have kept of your hens during the current breeding season constitutes the first basis of deciding which dams' poults you should save for next year's breeding work. Save poults from the dams that laid the best, especially from those dams whose sisters also laid well. Save poults from the sires whose sisters laid well, assuming, of course, that the sire in each pen has some full sisters in other pens.

Selecting Early-maturity Families. One of the most important characteristics that determines the number of eggs laid is early sexual maturity. The best way to measure sexual maturity is to count the days from January 1 to the time a bird commences laying. Not only do this for each hen in each pen but put the records of full sisters together and see if you have any families of full sisters that started laying earlier on the average than other families of full sisters.

Note particularly the average age at sexual maturity of the full sisters of each male used in the different pens. This will give you a clue as to which male from which you should select poults for future breeding work. Suppose in pen 2 you have a complete family of five full sisters all of which were early maturing, this family of five females being full sisters of the tom in pen 3. You feel sure then that the tom in pen 3 should transmit early maturity to his progeny, providing he is mated to early-maturing hens. Now if in pen 3 you have a complete family of four sisters all of which were early maturing, these four full sisters and the tom in pen 3 should produce progeny that will start to lay early the next breeding season.

In addition, go over the pedigrees of all hens in the various pens and see if certain groups of half sisters started laying earlier on the average than other groups of half sisters. This will give you additional information concerning differences in the ability of the brothers of each group of half sisters to transmit early sexual maturity to their progeny. After you have compared full-sister families and half-sister families with respect to early sexual maturity, you are ready to decide

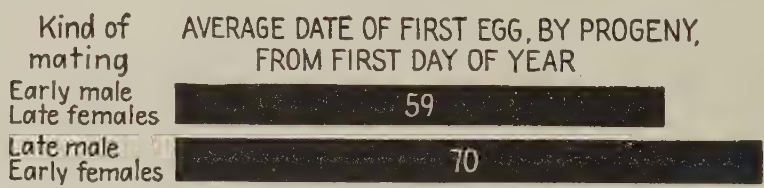


FIG. 38.—Reciprocal crosses of early sexual maturing and late sexual maturing strains gave results indicating sex linkage in the inheritance of sexual maturity. (*Graph made from data of V. S. Asmundson, University of California*, 1941.)

from which toms and hens in your current breeding pens you should save poults for the next year's breeding season to improve early sexual maturity in your flock.

Figure 38 shows that when an early-maturing and a late-maturing strain were crossed, the poults secured from mating an early-maturing male with late-maturing females started to lay sooner than the poults secured from mating a late-maturing male to early-maturing females. These results show that sex linkage is involved in the inheritance of sexual maturity.

Selecting Families That Have Few Pauses. Turkeys differ a great deal in the number of successive days they lay. Some turkeys lay one or two days in succession and then miss two or three days, and so on, for most of the rest of the season. Other turkeys lay anywhere from three to eight or nine eggs on successive days before missing one or more days. The number of eggs laid on successive days is called a "clutch." Clutch size is inherited. Therefore, by proper selection and mating you should be able to improve the laying ability of your strain.

Some turkeys skip several days between clutches and if the lapsed time, excluding a period of broodiness, exceeds seven days it is called a "pause." Naturally the more pause periods occurring in a hen's egg record, the lower the egg production, as shown in Fig. 39.

Broody periods are not considered as pauses, although they also reduce the number of eggs laid. "Break up" broody hens as quickly as possible to get them back into production. If your laying flock is lighted, broody hens should be kept lighted while being broken up. You can usually pick out broody hens by visiting the nests at night,

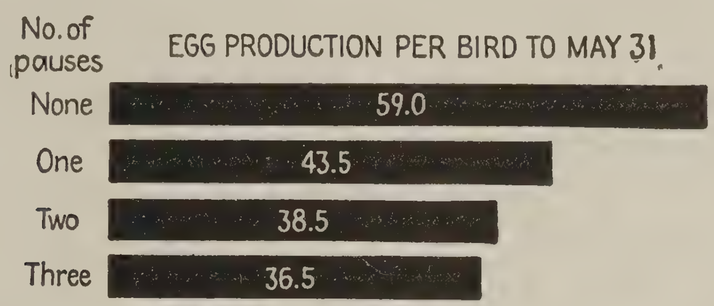


FIG. 39.—Since pauses decrease egg production, select poults for breeding purposes from hens that had few or no pauses. (*Graph made from data of S. J. Marsden, Bureau of Animal Industry, U.S. Department of Agriculture,* 1936.)

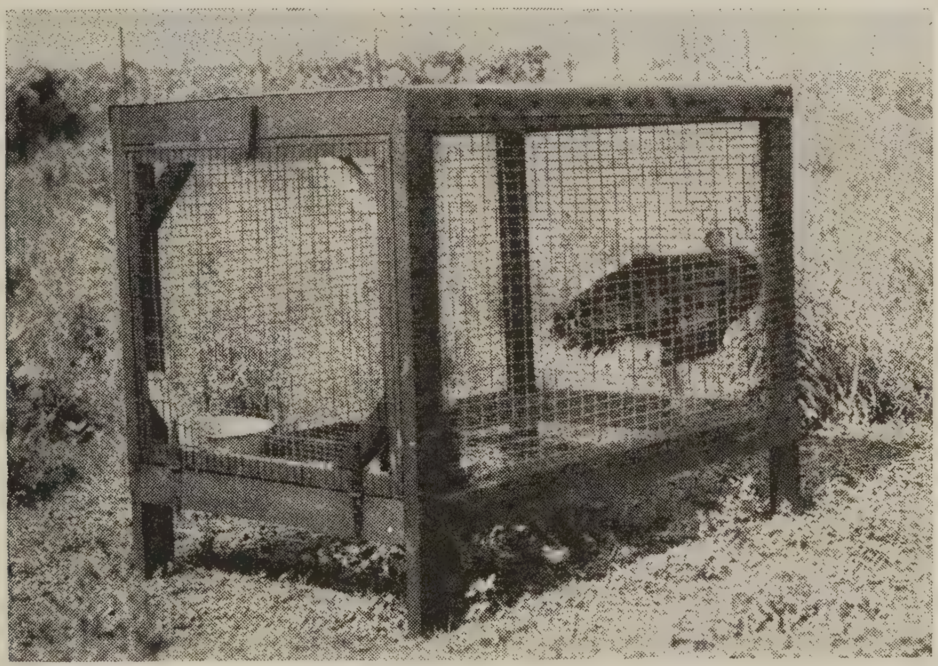


FIG. 40.—Coop for breaking up broody hens. (*T. B. Clark, T. D. Runnels, and E. A. Livesay, West Virginia Experiment Station.*)

because as soon as a hen becomes broody she persists in sitting on the nest. She also hisses when you approach her and is inclined to walk on her tiptoes. If you are in doubt, catch the bird and examine her vent. A dry, constricted vent indicates cessation of production whereas a large, moist vent indicates that the hen is still laying. If you are not carrying on pedigree-breeding work, the broody hen may be put in with a pen of toms or in a broody coop with wire or slatted floor for about 5 or 6 days (see Fig. 40). If you are doing pedigree-breeding work, put her in the broody coop and give her clean water and mash. Do not save poults from hens that go broody several times.

As far as pauses are concerned, in order to determine from which hens in your current breeding pens you should select progeny for future breeding purposes, go over the records of egg production of the hens on a family basis, first grouping together all full sisters and then all half sisters. For future breeding purposes select progeny of a hen that had the fewest pauses, especially if the hen's full sisters also had few pauses. Do the same for the dams that are half sisters so that you will be selecting the progeny of the best toms.

Selecting Families That Lay at a Good Rate. Besides early sexual maturity and absence of pauses, a good rate of laying is highly desirable. Go over the records of egg production and determine which families of full sisters and which families of half sisters laid the most eggs during March and April or even February and March if the birds were artificially lighted early in the season.

5. Securing Good Fertility

Since turkey eggs are not used as food for humans but are produced exclusively to secure poults, every infertile egg a breeding flock produces means a loss of money. In fact, in a large flock low fertility is quite costly.

Following Recommended Practices. Fertility is apt to be low among the first eggs laid by flocks in northern latitudes of the country and among all flocks during the late spring and early summer months. Fertility apparently is not inherited, so that securing good fertility is largely a problem of using toms of proper size for the hens and proper flock management. Good houses or shelters that provide ample protection against storms is the first step in securing good fertility.

Artificial Lighting Improves Fertility of Early Eggs. In northern latitudes the practice of artificially lighting the breeding stock to secure good egg production early in the season tends to increase fertility among the first eggs produced because artificial lighting stimulates the development of the reproductive organs. Since mating in turkeys usually results from advances made by the females, it is necessary to artificially light the males from one to three weeks prior to the time the females are lighted. As a matter of fact, in all parts of the country breeding pens should be made up a few weeks before the hens start to lay because their tendency to mate is less pronounced after they start laying.

One 100-watt lamp 8 ft. above the floor will light an 18′ × 18′ area.

Good Fertility Possible in 7 Days. Put the toms with the hens at least 1 month before the hens start laying. It is possible to secure fertile eggs within about 24 hr. after mating takes place and 90 per cent fertility is possible in a flock within about 7 days.

Good Fertility 2 Weeks after Toms Are Removed. Fertile eggs may be produced for as long as about 8 weeks after the males are removed from the breeding pen, but from a practical standpoint it is not wise to save eggs for hatching over 2 weeks after the males have been removed because fertility decreases rapidly thereafter. A turkey breeder carrying on pedigree-breeding work with single-tom pen matings and making a substitution of toms or replacing a dead tom should allow 4 weeks to elapse to be sure that the new male was the sire of the poults secured from the second mating. During the 4-week interval he could not be sure which male was the sire of the poults.

Securing Good Fertility in Flock Matings. In large flocks of several hundred hens, use one tom per 13 to 20 hens, depending somewhat on the size of the birds. For instance, the proportion of hens per tom should be lower in Broad-breasted Bronze flocks than in Beltsville Small-type White flocks. Also, in deciding on the number of toms to put with a flock of females allow for about one male in ten being sterile, unaggressive, or clumsy in mating. Young toms at least 8½ months old when matings are made up will give better fertility than old toms. If the flock is not too large, a double set of toms used alternately every 3 or 4 days will usually ensure excellent fertility. Fertility is apt to decline toward the end of the breeding season, so that some turkey breeders use a third set of toms. Move each group of males intact because if the two groups of males are mixed excessive fighting occurs. Plenty of range is necessary to allow the toms to mate freely with the hens. Steep hillsides make matings difficult in wet weather and fertility is lowered.

Since toms are inclined to spend considerable time fighting each other instead of mating with the hens, some turkey breeders put each tom in a small yard surrounded by stakes or boards spaced far enough apart to allow hens to pass through but not far enough apart for the tom to pass through (see Fig. 41). The hens in the flock thus have the opportunity of mating with any tom.

Securing Good Fertility in Pen Matings. In single-tom pen matings use one young tom per 12 to 20 hens or one old tom per

8 to 12 hens, depending upon the size of the birds. If trap-nesting is not carried on and no records are being kept with respect to hatchability of eggs or growth of poults secured from each separate pen, you can usually secure better fertility by using two or more toms alternately in each pen. If two toms are available, use each one every other day. If three toms are available, use one every third day or each day put one in the pen in the morning, the second one about noon, and the third one in midafternoon, removing the tom in the pen before making the substitution.

Fig. 41.—Stud-mating pens, in each of which one tom is confined, but hens may enter any tom pen. This arrangement prevents fighting among the toms. (*Oklahoma Agricultural College.*)

When pedigree-breeding work is being carried on, the tom placed in the pen at the beginning of the breeding season must be kept in the pen throughout the season, unless the first eggs from the pens are highly infertile or hatch poorly. When a substitute tom is placed in the pen, wait 4 weeks before being sure that the second male is the sire of the poults.

Testing for Fertility. Some turkey breeders candle the first few eggs secured from each pen after they have been in the incubator from about 7 to 9 days to determine whether or not any male is likely to produce a low percentage of fertile eggs throughout the season. At that stage of incubation an infertile egg is quite clear before the candle with the yolk plainly visible whereas a fertile egg shows good germ development, with small wavelike blood veins extending from the surface of the yolk.

Using Artificial Insemination. Turkey breeders interested in securing the largest possible number of progeny from an outstanding male by means of artificial insemination should write to the poultry department of their state college of agriculture, the address of which is given in the Appendix, or to the Bureau of Animal Industry, U.S. Department of Agriculture, Washington, D.C.

Using Other Means of Securing Good Fertility. Do not keep breeding flocks in adjoining yards unless a 4-ft. solid fence with 4 ft. of wire fencing above separates them, because if the toms in different yards see each other they spend much time at the fence. A vacant lot or yard between the yards occupied by turkeys helps in securing good fertility.

Do not clip the wings of toms, because this may interfere with his ability to mate. Clip each tom's toenails a few weeks before making up the matings and trim them every 3 or 4 weeks during the breeding season to avoid injury to the backs of females. Put saddles on the backs of females to avoid injury and to maintain good fertility. Keep the birds and houses free of lice and mites and keep the birds as healthy as possible or fertility will be affected.

6. Breeding for Good Hatchability

Hatchability refers to the number of poults hatched per 100 fertile eggs. Turkey breeders, however, think of hatchability in terms of the number of poults hatched per 100 eggs set in the incubator or under hens. From a practical standpoint the turkey breeder is interested in securing as many poults as possible from all eggs set, which means that fertility must be as high as possible and dead embryos during incubation as few as possible. However, since fertility apparently is not inherited but hatchability of fertile eggs is inherited, it is necessary to consider only the latter in determining how to select and breed for better hatchability.

Figure 42 shows that strains of the same variety sometimes differ markedly with respect to the hatchability of their fertile eggs. The results given in Fig. 42 are for two strains of White Holland females mated to the same males, which were rotated from pen to pen.

In Table 15 are given the results secured with four varieties with respect to fertility, hatchability of fertile eggs, and the percentage of poults secured from all eggs set.

It should be clearly understood that the results given in Table 15 pertain to the particular strains used of each of the four varieties and that other strains of the same varieties might give quite different

FIG. 42.—Showing a remarkable difference in hatchability of two strains of White Holland hens mated to the same males. Hatchability of fertile eggs is inherited and can be improved by the continuous selection of progeny secured from high hatchability dams. (*Graph made from data of P. H. Margolf, Pennsylvania Agricultural College,* 1944.)

results. With respect to the data in Table 15, it is interesting to note that because hatchability of fertile eggs was higher, the percentage of poults secured from all eggs set was higher in the case of Beltsville Small-type Whites than in the other three varieties. The low hatchability of fertile eggs in the case of Broad-breasted Bronze resulted in a relatively small percentage of poults from all eggs set.

TABLE 15. PERCENTAGE OF POULTS FROM ALL EGGS SET AS AFFECTED BY FERTILITY AND HATCHABILITY OF FERTILE EGGS IN FOUR VARIETIES

(D. Whitson, S. J. Marsden, and H. W. Titus, U.S. Department of Agriculture, 1944)

Variety	Eggs set per hen	Per cent		
		Fertility	Hatchability of fertile eggs	Poults of all eggs
Beltsville Small-type White	62	92.8	78.0	72.2
White Holland	63	96.8	71.9	69.7
Standardbred Bronze	76	94.5	73.4	69.4
Broad-breasted Bronze	59	81.5	48.8	41.3

TABLE 16. PERCENTAGE OF POULTS FROM ALL EGGS SET AS AFFECTED BY FERTILITY AND HATCHABILITY OF FERTILE EGGS IN BROAD-BREASTED BRONZE

(J. N. Thompson, Texas Experiment Station, 1943)

Pen number	Eggs set per hen	Per cent		
		Fertility	Hatchability of fertile eggs	Poults of all eggs
Pen 1	58	81	83	67
Pen 2	48	94	94	88
Pen 3	55	96	93	89
Pen 4	51	94	92	86
Average	53	91	89	81

By adopting a definite selection and breeding program it is possible to improve hatchability of fertile eggs markedly, as shown in Table 16.

The results given in Table 16 were secured as the result of selecting breeding stock each year based on the hatchability of eggs laid by the dams. Because hatchability of fertile eggs was high in all pens except No. 1, the percentage of poults secured from all eggs set was quite high. Hatchability of fertile eggs in pen 1 was significantly lower than in the other three pens, and further careful selection of breeding stock would be necessary to secure results comparable with the other three pens.

Securing good fertility is largely a program of using toms of the right size and good flock management, as pointed out previously. If you have not secured a satisfactory percentage of poults from all eggs set from your flock in the past, determine the extent to which low fertility is responsible and then you will know how much is due to low hatchability of fertile eggs.

A selection and breeding program to improve hatchability of fertile eggs involves trap-nesting the hens and hatching each hen's eggs separately from the others. Select poults for future breeding purposes from hens having the highest hatchability of fertile eggs, paying particular attention to the average hatchability of the fertile eggs of families of full sisters, because it is the superior families whose progeny you should select for future matings. In addition, compare the hatchability of fertile eggs secured from each of your single-tom mating pens to find out which toms gave better results than others.

The lower the hatchability of your turkey eggs, the higher the cost of producing poults. Suppose it costs $200 to produce 1,000 eggs. If 90 per cent of the eggs are fertile, 900 fertile eggs at $200 equals a little over 22 cents per fertile egg produced. If 60 per cent of the fertile eggs hatched, the cost per poult equals about 37 cents, whereas if 80 per cent of the fertile eggs hatched, the cost per poult is about 28 cents.

7. Breeding for Viability

In spite of the high mortality among many flocks of poults every year, relatively little seems to have been done by turkey breeders to develop strains for high viability. At least two things could be done toward attaining this goal. First, select future breeding stock from toms whose progeny suffered less mortality than the progeny of other toms. Second, select future breeders from dams whose progeny suffered less mortality than the progeny of other dams.

8. Developing a Turkey Improvement Program in Cooperation with Hatcheries

Turkey hatcheries are serving a more important role than ever in improving the quality of poults raised each year in all parts of the country. This has been brought about largely through the increased practice of turkey growers purchasing poults from hatchery operators who carry on a breeding improvement program with the flocks from which they secure hatching eggs. From the standpoint of turkey improvement work there are two kinds of hatcheries: a hatchery operated by a breeder who hatches poults from eggs produced exclusively by his own flock; and a hatchery for which hatching eggs are purchased from one or more breeders. The operator of a breeder hatchery has his breeding program under his immediate control, whereas a commercial hatchery depends upon other breeders to carry on the breeding work.

Producing the Quality of Poults Turkey Raisers Need. During recent years many turkey breeders have made considerable progress in developing efficient meat-producing and good-laying strains by carrying on *ROM* breeding work, the letters ROM meaning "Register of Merit." ROM breeding work is carried on under the provisions of the National Turkey Improvement Plan, the various states in which the work is carried on cooperating with the Bureau of Animal Industry of the U.S. Department of Agriculture. In each state in which the work is carried on, the selection and breeding program undertaken by turkey breeders is under the supervision of an official state agency. It is optional on the part of turkey breeders as to whether or not they cooperate in carrying on ROM breeding work under the National Turkey Improvement Plan, but those cooperating must comply with the provisions of the plan. The primary objectives of the plan are to improve the market quality of turkeys and to reduce losses from disease. For lack of space, only the more important features of the plan can be discussed here.

Emblem authorized for use by official State agencies and industry members to signify cooperation in The National Turkey Improvement Plan.

The preliminary step in carrying on ROM work is ROP work, which means

"Record of Performance," to build up the laying ability of flocks in order to reduce the costs of producing hatching eggs and poults. The fundamental part of the National Turkey Improvement Plan, however, is the ROM stage.

In order to qualify as U.S. ROP hens and toms, these birds must be approved by a state inspector of the official state agency not earlier than 22 weeks of age and after having met the minimum requirements of the U.S. ROP breeding stage of the plan.

U.S. ROP Hens. The minimum requirements for a young hen to qualify as a U.S. ROP hen include: (1) she must lay at least 46 eggs in 13 consecutive weeks, commencing with the first egg laid in a trap nest; (2) her eggs must weigh at least 30 ounces per dozen, the weight of each egg laid during 2 consecutive weeks, with a minimum of 10 eggs, being recorded by the breeder; (3) the eggs laid during 8 consecutive weeks, with a minimum of 28, must be set; (4) at least 70 per cent of all eggs set must hatch, except that at altitudes between 3,000 and 3,499 ft. the hatchability of all eggs set must be at least 65 per cent and at altitudes of 3,500 ft. or more the hatchability of all eggs set must be at least 60 per cent; (5) she must be a reasonably good representative of the variety and she must be of at least qualifying body weight for yearling hens as given in the American Standard of Perfection, body weight being taken at the time first egg is laid in the trap nest (for varieties not included in the American Standard of Perfection the qualifying weight must be established by the official state agency); (6) she must be free of any disqualification; (7) her eggs must be normal in shape and shell texture; (8) not earlier than 22 weeks of age she must be examined by the official state inspector and be banded with a U.S. ROP sealed, official leg band.

U.S. ROP Toms. The minimum requirements for a tom to qualify as a U.S. ROP tom include: (1) he must be the son of a U.S. ROP hen and a U.S. ROP tom; (2) he must be a good representative of the variety and possess strong constitutional vigor; (3) he must be free of any disqualification; (4) not earlier than 22 weeks of age he must be examined by the official state inspector and be banded with a numbered U.S. ROP sealed, official leg band; (5) at the time of inspection and banding, his wing-band and leg-band numbers and body weight must be recorded by the official state inspector.

U.S. ROP Matings. These matings consist of single-tom matings, that is, one tom is mated to a given number of females kept in a separate pen. The hens are trap-nested, their eggs are pedigree-hatched, the poults hatched are wing-banded, and the sire and dam of each poult is recorded.

U.S. ROP-candidate matings consist of hens entered in U.S. ROP for the purpose of obtaining egg production, egg weight, hatchability, and other necessary records to determine which of the candidates qualify as U.S. ROP hens during the first breeding year. Poults hatched are wing-banded with numbered and sealed bands marked "U.S. ROP Cand." If a U.S. ROP-candidate mating is headed by a U.S. ROP tom, the young tom progeny of the hens that qualify as U.S. ROP hens may qualify as U.S. ROP toms provided they meet all the requirements outlined previously for U.S. ROP toms.

U.S. ROP matings consist of U.S. ROP hens mated to a U.S. ROP tom, except that the mating may contain some hens that are not U.S. ROP hens but their eggs or progeny cannot be sold as U.S. ROP products. However, the young-tom progeny of non-U.S. ROP hens that qualify for U.S. ROP during the first breeding year may be permitted to head U.S. Certified flocks, described later, in that state in which they are produced or to head U.S. ROP matings on the breeder's own premises. The first step in establishing an official U.S. ROP mating is to keep the necessary records to qualify a number of hens as U.S. ROP hens. The next step would be to purchase U.S. ROP toms from a turkey breeder who already has U.S. ROP matings. A turkey breeder, however, may wish to carry on ROP breeding work but still confine his breeding operations within his own strain. Therefore, in order to make it possible for a turkey breeder to get started in ROP breeding work without having to purchase toms, during his first year in ROP he may use his own toms, providing they are of equal breeding to U.S. ROP toms. These toms may also be used a second year if they have been reinspected and passed by the official state inspector. No eggs or progeny secured from these beginner U.S. ROP matings may be sold as U.S. ROP products, except that young toms secured from a non-U.S. ROP tom and U.S. ROP hens may be permitted to head U.S. Certified flocks, described later, in the state in which they are produced or to head U.S. ROP matings on the breeder's own premises.

U.S. ROP hatching eggs are produced exclusively by official U.S. ROP matings. Each egg must bear the U.S. ROP number of the hen that laid it and the tom or pen number of the mating.

U.S. ROP poults are hatched exclusively from U.S. ROP hatching eggs, the eggs being pedigree-hatched and each poult banded with a sealed and numbered official wing band so that the sire and dam of each poult may be recorded.

Register of Merit Breeding Stage. This is the most important part of the National Turkey Improvement Plan because it is based on individual and family records of egg production, hatchability of eggs, viability of poults, and market quality of the progeny raised. The ROP breeding stage is primarily for the purpose of identifying the young toms and hens that are of superior quality. The ROM breeding stage is primarily for the purpose of determining the relative breeding worth of toms and hens that qualified for U.S. ROP. This is accomplished by progeny-testing a tom without trap-nesting the hens to which he is mated or by progeny-testing a tom and the hens to which he is mated, the latter being trap-nested.

U.S. ROM Toms. The minimum requirements for a tom to qualify as a U.S. ROM tom include: (1) all eggs laid by his mates, including an average of at least 20 eggs per hen and a minimum of 200 eggs laid by all hens, during a period of 8 consecutive weeks must be set; (2) at least 65 per cent of all eggs set must hatch, except that at altitudes of 3,500 ft. or more at least 55 per cent of all eggs set must hatch; (3) at least 75 per cent of all poults started, with a minimum of 100 poults from the mating, must be raised to 22 weeks of age; (4) at not less than 22 weeks of age at least 60 per cent of all young tom progeny and at least 80 per cent of all young hen progeny, with a minimum of 70 poults from the mating, must be of U.S. Grade A market quality except for pinfeather, fattening, and dressing specifications.

The turkey breeder should always keep in mind that the tom is "half of the breeding flock" and that he has on the average at least 10 times as many progeny as each of the dams to which he is mated. It is of the greatest importance, therefore, that the turkey breeder do everything possible to identify sires of outstanding breeding worth in order that they or their progeny from hens of outstanding breeding worth be used in subsequent matings.

U.S. ROM Hens. The minimum requirements for a hen to qualify as a U.S. ROM hen include: (1) she must be an excellent representative of the variety and must have excellent body conformation and at time of initial inspection must be well fleshed over the breast; (2) she must be trap-nested for 8 consecutive weeks, during which time she must lay at least 28 eggs; (3) all eggs laid during this 8-week period must be set; (4) at least 70 per cent of all eggs set must hatch, except that at altitudes of 3,500 ft. or more at least 60 per cent of all eggs set must hatch; (5) a minimum of 20 good poults must be hatched; (6) at least 16 poults must be alive at 22 weeks of age; (7) at not less than 22 weeks of age at least 60 per cent of her young tom progeny and at least 80 per cent of her young hen progeny, with a minimum of 12 poults, must be of U.S. Grade A market quality except for pinfeather, fattening, and dressing specifications.

A hen may qualify as a U.S. ROM hen if the following minimum requirement is substituted for items 2 to 5 above: she must produce poults at an average rate of at least 2¼ good poults per week during a period of 8 consecutive weeks.

U.S. ROM Single-tom, Non-trap-nested Candidate Matings consist of U.S. Approved hens, described later, and sons of U.S. ROM matings, the hens not being trap-nested. In order to make it possible for a breeder to get started in U.S. ROM breeding work within his own strain, U.S. Approved toms of outstanding quality may be used to head U.S. ROM matings during the first two years of such breeding work on his farm.

In this U.S. ROM-candidate mating the tom is merely a candidate until he qualifies as a U.S. ROM tom on the basis of the requirements set forth previously for U.S. ROM toms. If he qualifies, his progeny produced the same year he qualified are recognized as having been produced by a U.S. ROM mating.

The poults produced by each U.S. ROM-candidate mating must be hatched separately and each poult banded individually with an official sealed and numbered wing band marked "CT" to denote that the poults are the progeny of a candidate tom.

U.S. ROM Single-tom, Trap-nested Candidate Matings. These consist of U.S. Approved hens, described later, mated to sons of U.S. ROM matings, the hens being trap-nested. For a turkey breeder who wants to get started in U.S. ROM breeding work within his own strain the same exemption is made for the first two years as in the preceding mating.

In this U.S. ROM-candidate mating the tom and hens are merely candidates until they qualify as a U.S. ROM tom and U.S. ROM hens on the basis of the requirements set forth previously. If the tom or any of the hens qualify, his or her progeny produced the same year are recognized as having been produced by a U.S. ROM mating.

The poults secured from each hen in this U.S. ROM-candidate mating must be hatched separately and each poult banded individually with an official sealed and numbered wing band marked "CP" to denote that the poults are progeny of a U.S. ROM-candidate tom and a U.S. ROM-candidate hen.

U.S. ROM Matings. These may consist of any one of the following:
(1) a U.S. ROM tom remated to the same hens with which he qualified;
(2) a U.S. ROM hen remated to the same tom with which she qualified;
(3) a U.S. ROM tom remated to the same U.S. ROM hens with which he qualified.

The poults secured from each of these three kinds of U.S. ROM matings must each be banded with an official sealed and numbered wing band marked as follows: (1) U.S. ROM-T; (2) U.S. ROM-H; (3) U.S. ROM-TH, respectively.

Sons of U.S. ROM matings may be used to head U.S. Certified matings, described later, after these sons have passed official state inspection not earlier than 22 weeks of age and have been individually banded with an official sealed and numbered leg band lettered "U.S. Cert.-TS," "U.S. Cert.-HS," or "U.S. Cert.-THS" depending upon whether they are sons of a U.S. ROM tom, a U.S. ROM hen, or a son of a U.S. ROM tom and a U.S. ROM hen.

U.S.
CERTIFIED
N.T.I.P.

U.S. Certified Breeding Stage. This breeding stage of the National Turkey Improvement Plan enables turkey breeders and turkey hatchery operators to improve the quality of poults produced from flock matings through the use of U.S. ROP toms or the sons of U.S ROP matings. U.S. ROM toms, of course, may be used.

U.S. Certified Flocks. The hens used in these flock matings must be selected by a state inspector or flock-selecting agent authorized by the official state agency not earlier than 22 weeks of age. The selection must be done before Mar. 1 and not less than 30 days before eggs are saved for hatching. Hens selected must be banded with sealed and numbered wing bands obtained from the official state agency. All hens selected must be good representatives of their variety, free from disqualifications, have good body conformation including a straight, relatively long keel and good width of back and depth of body, good width of breast with excellent fleshing, sturdy legs of medium length placed squarely under the body, and shanks free of coarseness.

After the second year of U.S. Certified breeding work on any farm, the hens must be from U.S. Certified flocks or from U.S. ROP or U.S. ROM matings.

The toms used in these flock matings must be U.S. ROP toms or sons of U.S. ROP matings or they may be U.S. ROM toms.

U.S. Certified hatching eggs can be produced only by U.S. Certified flocks.

U.S. Certified poults can be hatched only from U.S. Certified eggs in U.S. Certified or U.S. Approved hatcheries, described later. If U.S. Certified poults are hatched in U.S. Approved hatcheries, the hatchery operator must avoid any possibility of mixing U.S. Certified and U.S. Approved poults, described later.

U.S. Certified hatcheries must be inspected by a state inspector at least twice during the hatching season and may sell U.S. Certified eggs and poults and eggs and poults from U.S. ROP and U.S. ROM matings.

U.S. Approved Breeding Stage. This breeding stage enables turkey breeders and turkey hatchery operators who do not have access to U.S. ROP toms or the sons of U.S. ROP matings to undertake the initial step in turkey improvement work.

U.S. Approved flocks consist of hens of the same quality as those used in U.S. Certified flock matings, except that they do not have to be free of all disqualifications, and toms that are as carefully selected as the hens. The same provisions for selection and inspection apply as in the case of U.S. Certified flocks.

U.S. Approved hatching eggs can be produced only by U.S. Approved flocks.

U.S. Approved poults can be hatched only from U.S. Approved hatching eggs and only in U.S. Approved hatcheries.

U.S. Approved hatcheries must be inspected by a state inspector at least twice during the hatching season and may not sell hatching eggs or hatch for sale or sell poults other than those produced under the breeding stages of the National Turkey Improvement Plan. U.S. Approved hatcheries may hatch for sale and sell U.S. Approved and U.S. Certified poults of the same variety or same color providing there is no possibility of mixing the poults of the two different breeding stages.

SUMMARY

1. A certain amount of inbreeding tends to "fix" desirable characters providing rigid selection is practiced from year to year to eliminate undesirable characters.

2. Crossing two outstanding strains of different varieties tends to increase hatchability and promote growth during the first few weeks.

3. Available evidence from different sources indicates that fertility and hatchability are adversely affected when excessively large birds are used as breeders, especially if the males are improperly balanced in body conformation and are too much larger than the females.

4. Single-tom pen matings provide an opportunity for progeny-testing sires and dams for egg production, hatchability of eggs, growth, viability, and fleshing of progeny.

5. Select your breeding stock before marketing any birds for the Thanksgiving or Christmas markets.

6. Select future breeders from families produced by the best sires and dams, on the basis of the dams' egg production and the hatchability of their eggs and on the basis of uniformity of body conformation, growth, and fleshing of the young toms and hens in each family.

7. Good egg production, to reduce the cost of producing hatching eggs and poults as pointed out in the previous chapter, can be developed in a flock by using artificial lights and by selecting future breeders each year from families of full sisters that (*a*) started to lay early; (*b*) had few pauses; (*c*) laid at a good rate.

8. Artificial lighting improves fertility of early eggs. Fertility of all eggs produced is improved by using sexes that do not differ excessively in weight.

9. Improve hatchability by selecting future breeders from full sisters whose eggs hatched well.

10. Try to improve viability by selecting future breeders from among families of full brothers and sisters that suffered relatively little mortality.

3. Renewing the Turkey Flock

The problem of renewing the turkey flock every year is a very important one because of the cost of hatching eggs and poults and because of the relatively high proportion of flock replacements made, even in the case of turkey breeders. If you are a turkey grower, you will probably renew your entire flock each year by purchasing poults. If you are a turkey breeder, you will probably replace most of the breeders kept the previous year and you will replace all of the market turkeys raised each year.

The number and quality of poults secured from a given number of hatching eggs is determined by the quality of breeding stock that produces the eggs, their fertility and hatchability, and by the degree of efficiency in incubating the eggs. The two preceding chapters discussed how to produce the right kind of hatching egg. Improper care of the hatching eggs and faulty methods of incubation lower hatchability and increase the cost of hatching poults. How to secure satisfactory results in hatching poults is discussed under the following activity headings:

1. Collecting, Holding, and Shipping Hatching Eggs
2. Hatching Poults under Hens
3. Hatching Poults in Incubators
4. Checking on Factors Affecting Hatchability
5. Judging Baby Poults
6. Securing Poults from a Hatchery
7. Shipping Baby Poults

1. Collecting, Holding, and Shipping Hatching Eggs

The number of poults secured from hatching eggs may be reduced considerably if the eggs are not collected frequently and stored properly between collecting and setting time. Collect them in wire baskets at least four times daily—every 2 hr. in the case of large flocks in hot weather—because the embryo starts to develop at temperatures above 70°F. Frequent daily collections reduce breakage and dirty eggs, particularly if you are using barrels or open box nests. Remove all hens remaining on nests at night.

Take the eggs immediately to a cool room, where the temperature is maintained at about 50 to 60°F., preferably keeping them in the wire baskets or pails before packing them in the egg case. Always pack them large end up if you pack them in an egg case. They can be laid in a horizontal position but should never be held small end up. Remember that the body temperature of the turkey hen is about 106.5°F., and her egg must be cooled rather soon after being laid or embryo development may begin. The cellar of the house, the milk room, or an egg cooler is a good place to hold the eggs. Plenty of humidity is desirable in dry climates. In egg storage rooms in all parts of the country the relative humidity of the air should be about 60 per cent.

Clean any dirty eggs with No. 3 coarse steel wool.

For best results in hatching, do not hold hatching eggs over 10 days, as indicated by the data in Table 17.

TABLE 17. PERCENTAGE OF HATCHABILITY OF TURKEY EGGS IN RELATION TO TEMPERATURE AND HUMIDITY DURING DIFFERENT PERIODS OF HOLDING PRIOR TO INCUBATION

(H. M. Scott, Kansas Experiment Station, 1933)

Period held in days	Temperature and humidity during holding			
	Temp., 60–75°F. Humidity, low	Temp., 55–60°F. Humidity, high	Mean temp., 36.3°F. Mean wet bulb, 35.3°F.	Mean temp., 54.2°F. Mean wet bulb, 52.5°F.
0– 6	71.9	89.3	65.6	71.0
7–13	73.4	90.0	52.4	65.0
14–20	44.6	84.8	26.8	74.6
21–27	14.1	84.0	5.9	67.3
28–34	6.3	85.7	0.0	61.1

If you must hold the eggs over 10 days, turn them daily by tilting the egg cases one way one day and the other way another day, as shown in Fig. 43.

In selecting eggs for setting, go over all eggs carefully and reject those with cracked shells. When two eggs are tapped together lightly a resonant sound is produced if both shells are sound but a dead sound is produced if one of the shells is cracked. Of course, if you are a pedigree turkey breeder you could put adhesive tape or mucilage over the crack of a valuable egg. Reject all eggs with thin shells, all eggs with rough shells, and all eggs with chalky-white porous shells because they are all likely to hatch poorly. Again, if you are

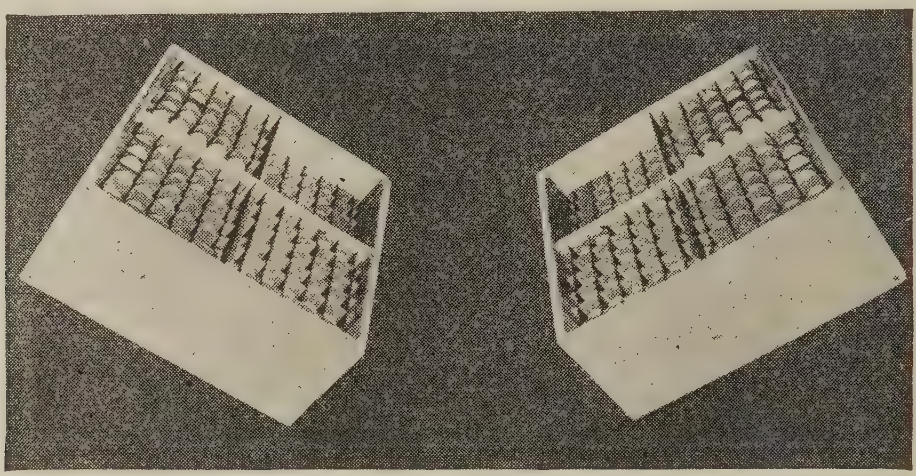


FIG. 43.—A laborsaving way of turning hatching eggs while they are held prior to incubation. The cases are tipped one way one day and the other way the next day. (*P. H. Gooding, South Carolina Extension Service.*)

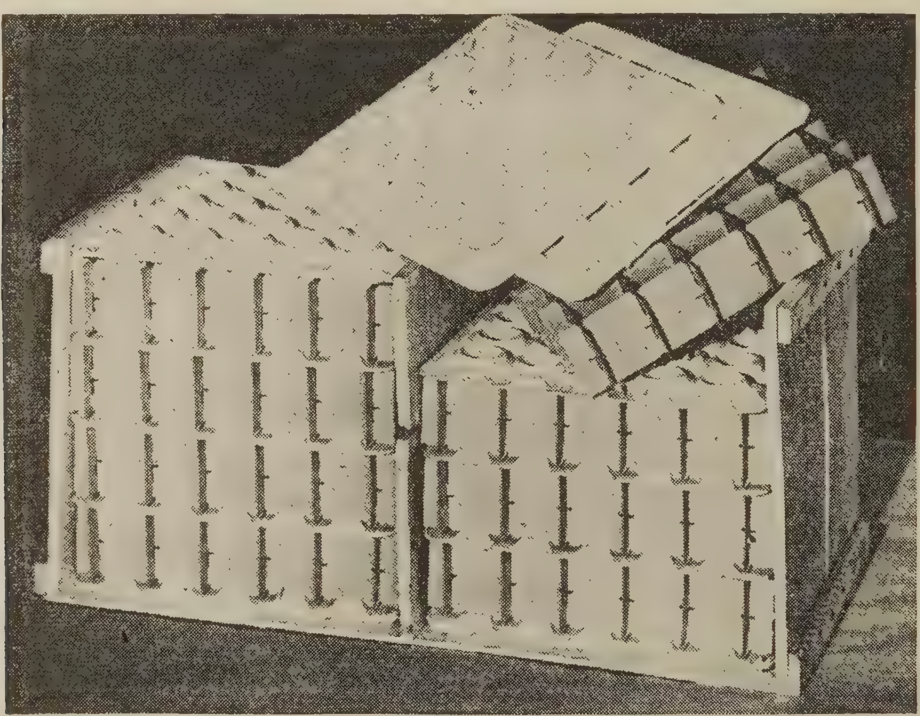


FIG. 44.—Turkey egg case. (*Central Fibre Products Co.*)

a pedigree breeder and find that a certain hen lays a number of these poor eggs, reject her from the mating.

If you sell hatching eggs to a hatchery operator, be as careful in selecting the eggs to ship as though you were going to incubate them to produce poults for yourself. Pack the eggs tightly with the large end up, using fillers designed for turkey eggs. A case holds 200 eggs.

Hatching eggs that are to be shipped a considerable distance should be only a few days old when shipped.

2. Hatching Poults under Hens

Hatching poults under chicken or turkey hens is still possible, although it is going out of date for several reasons. When either chicken or turkey hens are used they may be responsible for the poults hatched becoming infected with either the pullorum or the blackhead disease or both. Only broody hens tested and found to be free of pullorum disease should be used. Also, the poults may become infested with lice. To avoid this possibility, dust the hen with sodium

FIG. 45.—Hatching poults under hens, a common practice several years ago. (*L. E. Cline, Nevada Extension Service.*)

fluoride at setting time and again, if necessary, not later than 10 days before the poults are to hatch. Do not use mercurial ointment for lice, as embryos in the eggs may be killed.

If you depend on hens to incubate your turkey eggs, you must wait until they are broody and, therefore, cannot always hatch the poults as early as you might want to. Early-hatched poults usually grow faster than late-hatched poults. The hot weather of July and August has a retarding effect on growth. Moreover, if you use the turkey hens that go broody you are using your earliest maturing birds, which are the ones from which you should secure the most poults. Also, instead of breaking up these broody turkey hens to get them back into egg production as soon as possible, you deprive them of several weeks' production and thus lose money on the eggs they should have produced. In addition, the number of poults you can hatch at any one time is limited by the number of broody hens available. It is often practicable to set two hens at the same time and give all of the poults hatched to one hen. A chicken hen will cover from 8 to 11 eggs, depending upon her size and the size of the eggs, and a turkey hen will cover from 15 to 18 eggs.

Make the nest for a turkey hen about 2 ft. square in a cool, quiet place away from the rest of the flock. Scoop out a bit of earth and sprinkle coal-tar disinfectant over the soil. Fill the bottom of the nest with straw, shavings, or rice hulls. An A-shaped coop, as shown in Fig. 45, makes a desirable arrangement for protecting the hen. The wired front portion serves to confine the poults for the first few days, after which they may be allowed outside while the hen is still confined. During the incubation period feed the hen mash, grain, grit, and green feed, and give water regularly.

3. Hatching Poults in Incubators

Hatching poults in incubators has several advantages over hatching poults under hens. (1) The poults can be hatched whenever they are desired. (2) Larger numbers of poults can be hatched at any one time. (3) There is less danger of the poults contracting disease, providing the incubator is properly disinfected by fumigation. (4) Broody turkey hens can be broken up as soon as detected and kept laying. (5) There is relatively less labor involved in artificial than in natural incubation in relation to the number of poults hatched. (6) Hatching in incubators makes it possible to sell poults commercially.

There are several different types of incubators on the market but since they are described in "Successful Poultry Management," a companion volume to this book, as well as in some of the other books listed in the Appendix, a detailed description of incubator types is not included here.

Operating the Incubator. The room in which the incubator is operated should be kept at about 70°F. The four principal factors that affect the number of poults hatched from the fertile eggs set are (1) temperature, (2) humidity, (3) ventilation, and (4) turning. Each of these factors influences the growth of the embryo during incubation. The first three factors are interrelated, a change in any one factor automatically affecting the other two.

Hatching eggs are usually placed in the incubator trays in a horizontal position or with the large end up at an angle of 45 deg. from horizontal. Relatively more embryos have the head in the small end of the egg when the eggs are incubated horizontally than when they are incubated with the large end up during the first 24 days. Eggs with embryos in the small end do not hatch so well as eggs with the embryos in the large end.

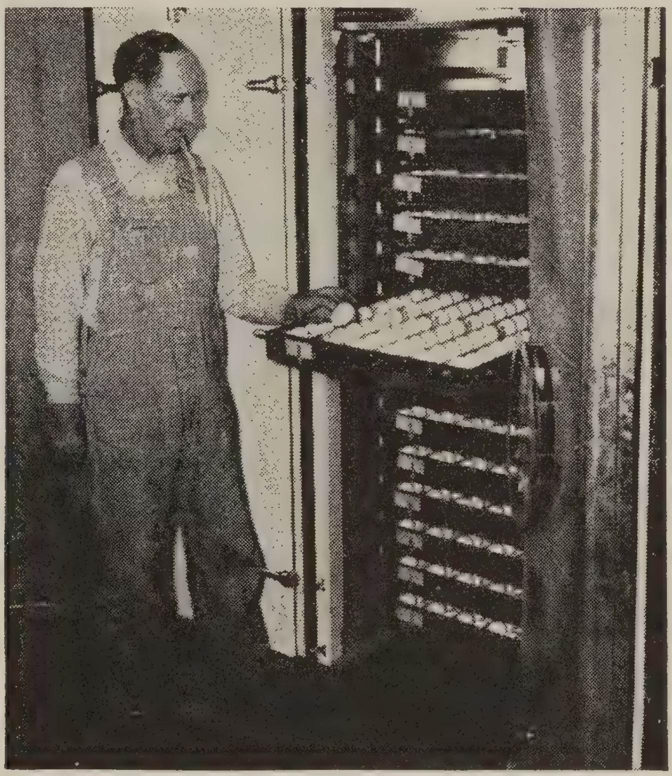


Fig. 46.—Cabinet-type incubator. (*Turkey World.*)

Maintain Proper Temperature. To maintain proper temperature throughout the incubation period, test your incubator thermometer once a year with a clinical thermometer, which may be procured from a physician or at a drugstore. Place the incubator and clinical thermometers in warm water heated to about 103°F., taking care to keep the bulbs near each other and at the same level in the water. The incubator thermometer should register the same temperature as the clinical thermometer.

Follow closely the instructions of the incubator manufacturer for the particular incubator you have.

If you have a section-type or gravity-ventilated incubator, start it up at least 2 days before you intend to set the eggs, so that at setting time the temperature is 100.5°F. For the first week keep the temperature at 100.5°F., for the second week 101.5°F., for the third week 102.5°F., and for the fourth week 103°F. These are the proper weekly temperatures at 1⅞ in. above the egg tray, which should not sag anywhere.

If you have a cabinet-type incubator in which the air in the chamber is agitated or has forced-draft circulation of air, maintain a temperature of 99.5°F. throughout the 28-day incubation period, or during the last 4 days maintain a temperature of 100.5°F., depending upon the incubator and the section of the country in which you

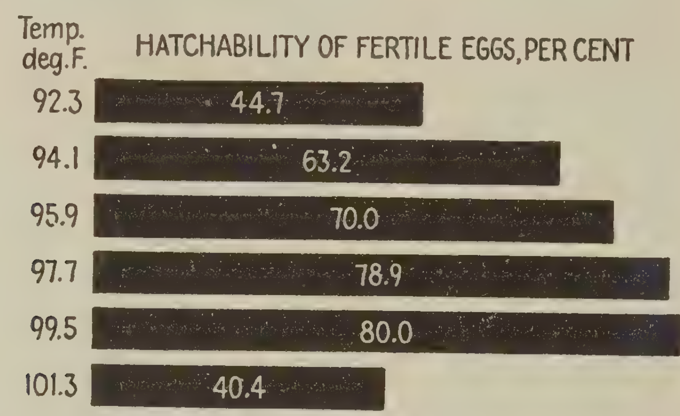


Fig. 47.—Showing differences in hatchability of eggs kept at different temperatures during the fourth week of incubation. A forced-draft incubator was used. During the first 3 weeks a temperature of 99.5° F. was maintained, a relative humidity of about 65 per cent, and the eggs were turned three times daily. During the fourth week the temperatures indicated at the left of the bars were maintained on the different lots, but relative humidity for all lots was 65 per cent and eggs were turned three times daily to twenty-fourth day. (*Graph made from data of A. L. Romanoff, Cornell University.*)

live. If poults are hatched in the same compartment throughout the entire incubation period, the temperature during hatching time should be maintained at 99.5°F. because that is the best temperature for the other eggs in the incubator. However, many incubator manufacturers provide a separate compartment for hatching the poults, the eggs being transferred from the regular incubating compartment to the hatching compartment on the twenty-first or twenty-fourth day. When a separate hatching compartment is available, the eggs are transferred to the hatching compartment on the twenty-fifth day and in some makes of incubators the temperature should be lowered to about 97°F., as shown in Fig. 48, whereas in other incubators the hatching-compartment temperature should be 99 to 99.5°F.

Provide Correct Humidity. A certain amount of humidity of the air in the incubator, and hatcher, is necessary to prevent the eggs from losing too much moisture by evaporation of the water content of the egg through the porous shell and to provide optimum conditions for the growth of the embryo. When correct humidity conditions are provided, the eggs lose weight at about the following rates: up to 6 days of incubation, about 2.5 to 4 per cent loss in weight; up to 12 days, about 4.5 to 6.5 per cent loss in weight; up to 18 days, about 7.5 to 9.5 per cent loss in weight; up to 24 days, about 10.5 to 13.5 per cent loss in weight, depending on thickness of shell and

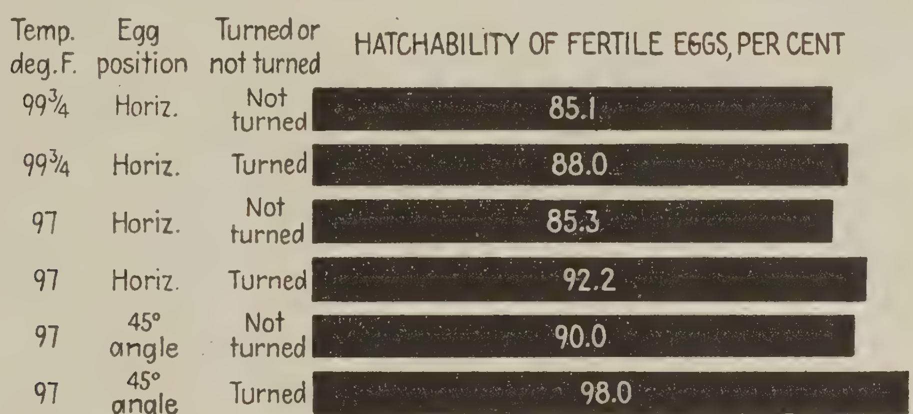


FIG. 48.—These hatchability figures are for six lots of eggs given the different treatments stated at the left during the fourth week of incubation. During the first 3 weeks all lots were incubated together in a forced-draft incubator kept at 99.5 to 100° F.; the eggs were kept at an angle of 45 deg. from horizontal and they were turned three times daily. (*Graph made from data of T. C. Byerly, S. Haynes, and S. J. Marsden, U.S. Department of Agriculture.*)

size of egg. On the average, a poult weighs about 66 per cent of the weight of the egg from which it was hatched.

Humidity is the moistness of air. When a body of air cannot take up any more moisture at a given temperature it is said to be fully saturated. Relative humidity refers to the ratio between the amount of water vapor actually contained in the atmosphere at a given temperature and the amount of water vapor the atmosphere is capable of holding at the same temperature. The capacity of air to hold moisture increases as the temperature rises. The approximate percentage of relative humidity of the air in the egg chamber is determined by comparing the wet-bulb reading with the temperature shown on the dry-bulb thermometer used to determine the temperature of the air in the egg chamber. The data in Table 18 give relative percentage of humidities at different wet-bulb and dry-bulb readings.

TABLE 18. PERCENTAGE OF RELATIVE HUMIDITY IN RELATION TO DIFFERENT WET-BULB AND DRY-BULB READINGS

Wet-bulb reading, °F.	Dry-bulb reading, °F.			
	98°	99°	100°	101°
92	79%	76%	74%	71%
91	76	73	71	68
90	73	70	68	65
89	70	67	65	63
88	67	65	63	60
87	65	62	60	57
86	61	59	57	54
85	58	56	54	51

The optimum percentage of relative humidity to be maintained in the incubator may vary slightly in different parts of the country, apparently being lower in the Southwest than in the North and Northeast, but in general it should be about 60 per cent during the

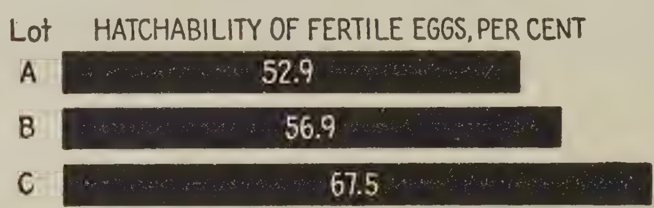


FIG. 49.—These three lots of eggs were incubated for 24 days in a cabinet incubator and during the last 4 days were given the following treatments: Lot *A*, small cabinet incubator, 69 to 73 per cent relative humidity, temperature 99¾ to 100¼° F.; lot *B*, small cabinet incubator, 50 to 54 per cent relative humidity, temperature 99¾ to 100¼° F.; lot *C*, gravity-ventilated incubator with moisture pan, temperature 103 to 104° F. at top of eggs. (*Graph made from data of F. E. Mussehl and C. W. Ackerson, Nebraska Experiment Station.*)

first 24 days and about 70 to 74 per cent during the last 3 days of incubation (see Figs. 49 and 50). In section-type or gravity-ventilated incubators moisture is supplied from moisture pans beneath the egg trays. In forced-draft incubators moisture is supplied by an automatic humidifying device. In some parts of the country damp cloths are laid over the top of the hatching trays or on the sides of a forced-draft cabinet during the last 3 days of the incubation period, the cloths being dampened three times daily. Too high humidity, however, is dangerous. During the last 4 hours of the hatching period, decrease the humidity to permit the poults to dry off properly.

Provide Adequate Ventilation. Developing embryos need oxygen and give off carbon dioxide. Incubators should be ventilated so that the air in the egg chamber contains 21 per cent of oxygen, the oxygen content of normal air. As the incubation period progresses, more carbon dioxide is given off, hence more ventilation is required. In most instances adequate ventilation is provided when the manufacturer's directions are followed carefully.

Turn the Eggs. Turn the eggs at least five times daily up to the twenty-second day, the first turning being done as early as possible in the morning and the last turning as late as possible at night. If you operate a section-type incubator, remove a few eggs from the

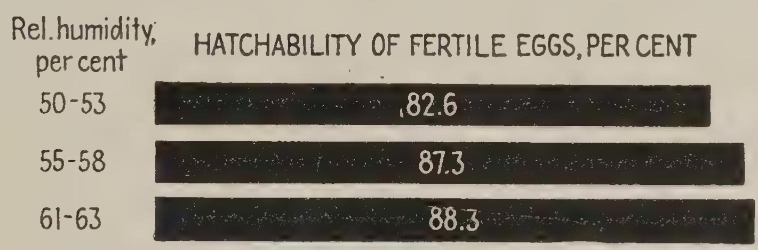


FIG. 50.—These three lots of eggs were incubated in a forced-draft incubator for 24 days at 99.5° F. and with relative humidity for each lot as indicated. During the last four days they were in a hatchery compartment maintained at 99° F. and 70 per cent relative humidity, the wet-bulb reading during the four days being kept at 90° F. (*Graph made from data of W. M. Insko, Jr., D. W. MacLaury, and A. T. Ringrose, Kentucky Experiment Station.*)

center of the tray, roll the others toward the center of the tray, and then replace the ones removed to the outer corners of the tray. Forced-draft incubators are equipped with automatic turning devices that make turning eggs a simple problem. Turning the eggs after the twenty-first day appears to be unnecessary, and certainly do not turn them after the twenty-fourth day.

Testing the Eggs. If you are a commercial hatchery operator you will probably only test your eggs when they are moved from the incubating compartment to the hatching compartment. However, if you want to know whether or not a certain pen of birds or each of your flock matings is producing a high percentage of fertile eggs among the first eggs laid, test them by about the tenth day (see Fig. 51). Also, at the same time you could detect living embryos and dead germs, eliminating the latter (see Fig. 51). By the tenth day the live germ or embryo is readily distinguished near the center of the egg as a small dark spot with spiderlike blood vessels radiating from it, as shown in Fig. 51. Make a second test on the twenty-first day, again eliminating the dead germs and putting the eggs with live germs in the hatching compartment. Transferring the eggs from the incubating to the hatching compartment on the twenty-first day would be advantageous from a practical standpoint to a commercial hatchery operator.

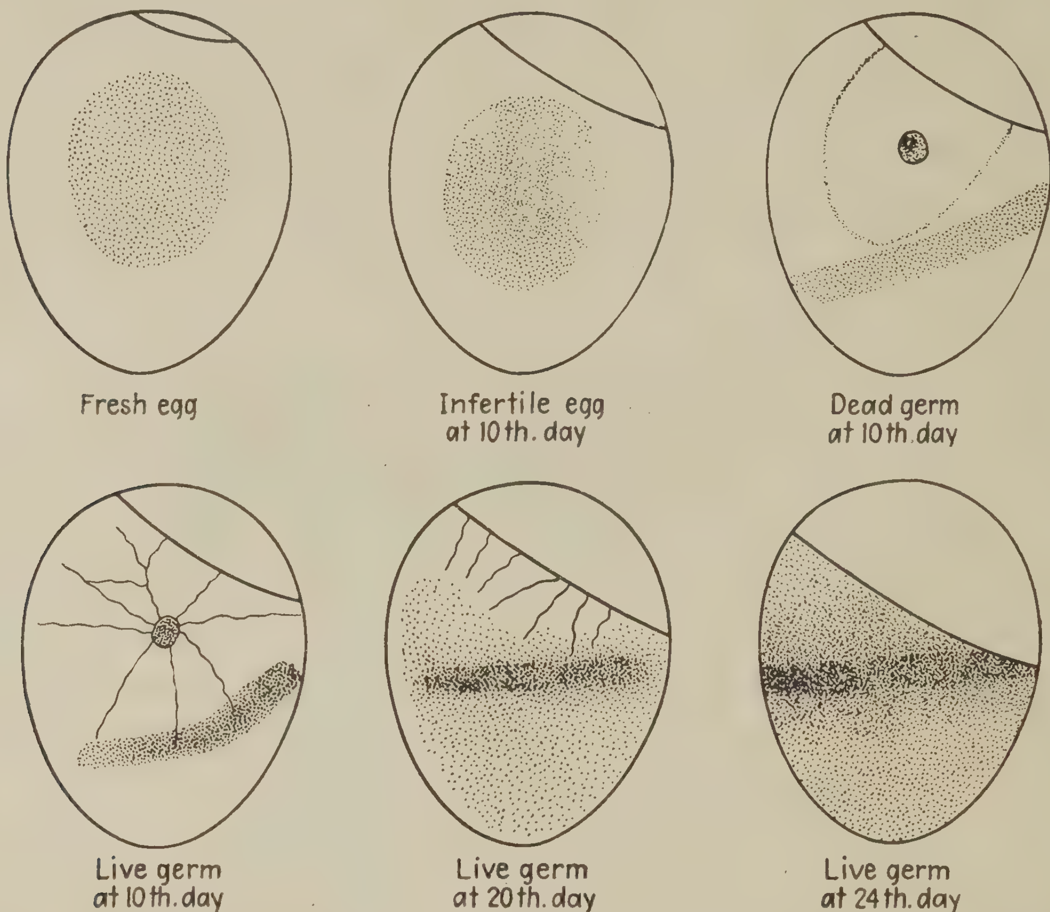


FIG. 51.—Showing what to look for on the tenth, twentieth, and twenty-fourth days of incubation. (*V. S. Asmundson, California Experiment Station.*)

Fumigating Incubator against Pullorum Disease. Pullorum disease often causes high mortality among poults during the first 2 or 3 weeks after hatching time. A hen infected with the organism that causes the pullorum disease may transmit the disease to her poults through the medium of the hatching egg. An infected poult that is hatched from an infected egg may be responsible for spreading the disease to other poults at hatching time.

All birds used for breeding purposes should be tested in order that those infected with the pullorum organism may be removed from the flock before hatching eggs are saved. The method of testing is described in Chap. 6.

Although all breeding flocks should be tested and reactors to the test removed upon the completion of the test, it must be remembered that it is possible for birds to pass one test but show later that they harbor the organism causing the disease. Also, mistakes in testing sometimes occur. It is important, therefore, in addition to testing the flock, to disinfect the incubator in order to prevent any possible spread of the disease from infected to healthy poults. Disinfecting the incubator is accomplished by fumigation. *Fumigation is not a substitute for pullorum testing* but is an additional step to prevent the possible spread of infection.

The fumigants used in incubator fumigation are 40 per cent Formalin and potassium permanganate, both of which can be purchased at a drugstore. Use 35 cc. or 1⅙ oz. of Formalin added to 17½ grams or ½ oz. of potassium permanganate for each 100 cu. ft. of air space in the incubator, which may be determined by measuring the outside dimensions. Place the crystals of potassium permanganate in a large pan directly under the fans of the forced-draft incubator, and pour the Formalin over them. Wear rubber gloves and do not allow the Formalin to come in direct contact with the hands.

Operate the incubator at normal temperature. The wet-bulb reading, however, should be 90 to 93°F. in order to ensure high relative humidity for effective fumigation. The first fumigation should be done when about 15 to 20 per cent of the poults have hatched but are not dried off. Repeat at 12-hr. intervals until three fumigations have been completed. Poults that have dried off, however, should be removed before fumigating the incubator each time. It is very important to keep in mind that poults should never be subjected to two fumigations, nor should any poults be fumigated after they have dried off or are over 24 hr. old.

Open the doors of the incubator at the expiration of 3 hr. after the commencement of fumigation. Remove the poults that have hatched up to that time to clean quarters.

In order to facilitate working in the incubator room while the incubator is being fumigated, some operators neutralize the formaldehyde gas with ammonium hydroxide (26 per cent) after fumigation has been in progress for from 5 to 8 min. The ammonia water is sprayed over the interior of the incubator; about one-half as much ammonium hydroxide as Formalin is used. Follow special instructions given by the incubator manufacturer concerning incubator fumigation.

Taking Off the Hatch. When approximately one-half of the poults have hatched, it is well to open the incubator or hatching compartment and remove them from the tray to make more room for the others that will hatch later. Gravity-ventilated types of incubators are usually equipped with a strip at the front of the egg tray to permit poults to drop into the nursery tray as they naturally crowd

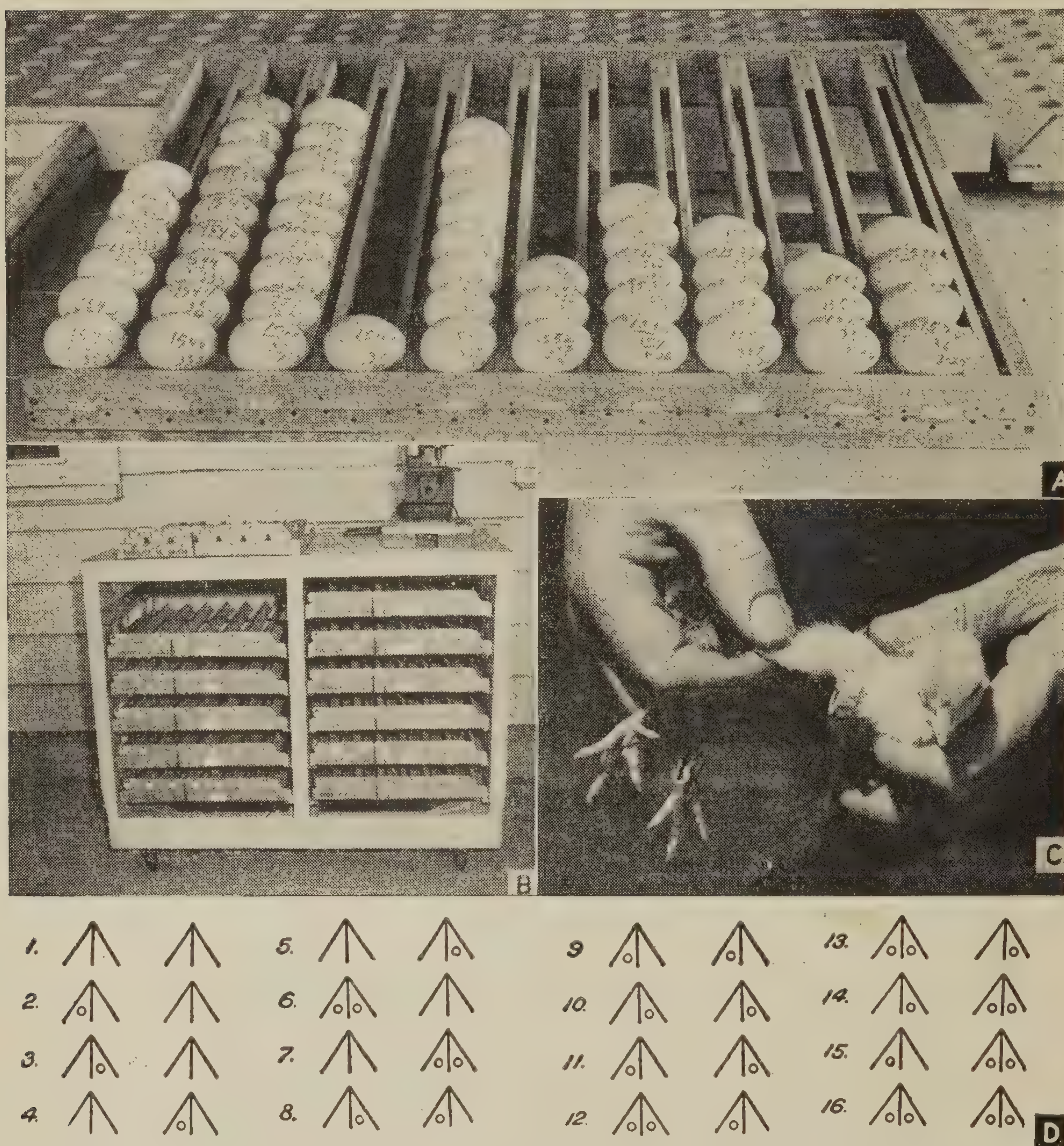


FIG. 52.—Steps in traying eggs and identifying poults. (*A*) Traying the eggs. (*U.S. Department of Agriculture.*) (*B*) Table for holding trays. (*J. N. Thompson, Texas Experiment Station.*) (*C*) Wing-banding the poults. (*U.S. Department of Agriculture.*) (*D*) Toe-punching system to identify poults secured from different dams, different sires, or groups of poults hatched at different times.

toward the front of the incubator. Keep this strip in place until about one-half of the poults have hatched. Remove the water pan beneath the egg tray and fasten burlap or hardware cloth to the bottom of the nursery tray to give it a rough surface, because poults kept on a smooth surface are apt to develop "spraddle legs." In forced-draft types of incubators with separate hatching compartments, remove the first half of the hatch and put them in poult boxes. Apparently one of the most effective ways of preventing "spraddle

BREEDING-PEN AND SIRE-SUMMARY RECORD

Flock owner ______________ (Name) ______________ (Address)

Variety ______________ Pen No. ______________ Year ______________

TOM

Leg-band No. ______________
Wing-band No. ______________
Body weight at ______ wks. of age ______________
Date hatched ______________

Leg-band No. of sire ______________
Wing-band No. ______________

Leg-band No. of dam ______________
Wing-band No. ______________
Egg production ______________
Egg weight (Oz. per doz.) ______________
Hatchability ______________
Viability of progeny ______________
Market quality of progeny ______________

PRODUCTION RECORD OF HENS					INCUBATION RECORD							
Leg-band No.	Wing-band No.	Egg prod.	Egg wt. oz.	Body wt. lb.	No. eggs set	No. eggs inf.	No. plts. htd.	Pct. htch. fert. eggs	Pct. htch. totl. eggs	No. eggs sold	No. plts. sold	Remarks
Totals and Tom's summary												

FIG. 53.—Form for recording the egg production, egg weight, and body weight of each hen mated to a tom, and the incubation results from eggs set. By summarizing the data at the bottom of each column, you get hatching results for the tom. (*U.S. Department of Agriculture.*)

legs" in poults is to keep the eggs and poults in the hatching compartment fairly crowded.

Baskets for pedigreeing poults hatched from each dam should be at least 1¾ in. deep or, better still, 2 in. deep.

Do not open the incubator door any oftener than is absolutely necessary, because this lowers both temperature and humidity. Helping some of the weaker poults may be justified, although if you have many of them you should question the quality of the hatching

PEDIGREE INDEX

Name __________ Variety __________ Year __________

Poult wing-band No.	Pen. No.	Dam's No.	Poult wing-band No.	Pen. No.	Dam's No.	Poult wing-band No.	Pen. No.	Dam's No.
1			41			81		
2			42			82		
3			43			83		
4			44			84		
5			45			85		
6			46			86		
35			75			115		
36			76			116		
37			77			117		
38			78			118		
39			79			119		
40			80			120		

FIG. 54.—Pedigree index that enables you to identify the pen (tom) and dam from which each poult was secured. (*U.S. Department of Agriculture.*)

N. T. I. P. Form 10T

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Animal Industry
The National Turkey Improvement Plan

__________ Dam

__________ Pen

PROGENY RECORD

Name __________ Variety __________

Poult Wing-band No.	Date of hatch	Sex	Disposal	Quality, weight, and additional data at given age					
				Age in weeks	Weight in pounds	Market quality			

FIG. 55.—Progeny record form for recording data on the progeny of each dam. (*U.S. Department of Agriculture.*)

Dam's leg-band No.	PROGENY RECORD																	
	Poults started	Poult viability	No. U. S. grade A or better	Young toms							Young hens							Remarks
				Total No.	No. U. S. grade			Avg. wt. at ___ wks.	Other data		Total No.	No. U. S. grade			Avg. wt. at ___ wks.	Other data		
					A	B	C					A	B	C				
Sire's Summary																		

FIG. 56.—Progeny record form for recording data on the progeny of each sire. (*U.S. Department of Agriculture.*)

FIG. 57.—Thoroughly clean and disinfect the incubator after every hatch. (*Turkey World.*)

eggs set or methods of incubation or both. In fact, every time you secure an unsatisfactory hatch you should study carefully all possible factors involved and try to correct them.

Keeping a Record of Hatching Results. It is quite important to keep a record of results secured from each setting of eggs secured from each flock mating and from each pen mating. By keeping a record of the number of fertile eggs and dead germs in each setting of eggs you are in a better position to determine the possible causes of low fertility and poor hatchability than when no records are kept. In some cases it is possible to correct mistakes before later settings are started. Compare the hatching results secured from different flocks and pens.

Disinfecting after Hatch Is Completed. After the hatch has been taken off, clean and thoroughly disinfect the interior of the incubator and the egg trays. Filth tends to accumulate in incubators and may give rise to the spread of disease. For disinfecting, use a 3 per cent solution of any of the standard coal-tar stock dips.

4. Checking on Factors Affecting Hatchability

A poor hatch may be due to a variety of causes. Low fertility reduces the number of poults hatched even if the fertile eggs hatch well. Test for fertility about the tenth day of incubation and if

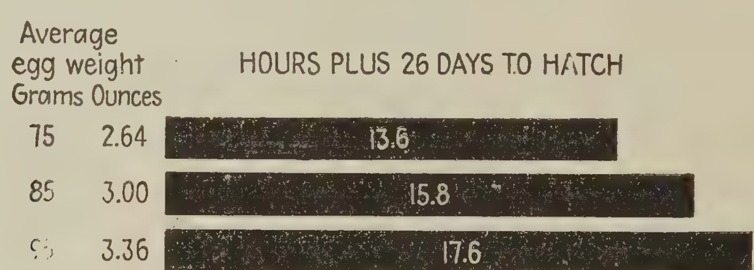


FIG. 58.—Incubation period in these Beltsville Small-type White turkey eggs increased as egg size increased. Among the eggs as a whole the range in incubation time varied from 25 days and 6 hr. to 28 days. (*Graph made from data of M. W. Olsen, Bureau of Animal Industry, U.S. Department of Agriculture.*)

necessary substitute males in the pens or matings, or use alternate males as outlined in the preceding chapter.

Setting thin-shelled eggs, eggs with rough shells, and eggs with chalky-white porous shells may reduce the hatch.

Too low a temperature during incubation retards embryo development and results in a late hatch and may be responsible for high embryo mortality. Too high a temperature stimulates embryo development and may cause excessive embryo mortality.

During the latter part of the breeding season hatchability tends to decline, although the reason for this has apparently not been determined.

In any given flock of turkeys, the largest eggs require a few hours longer to hatch than the smallest eggs, as shown in Fig. 58.

In any given flock the smallest and the largest eggs tend to hatch less well than those in between, as shown in Figs. 59 and 60. It is

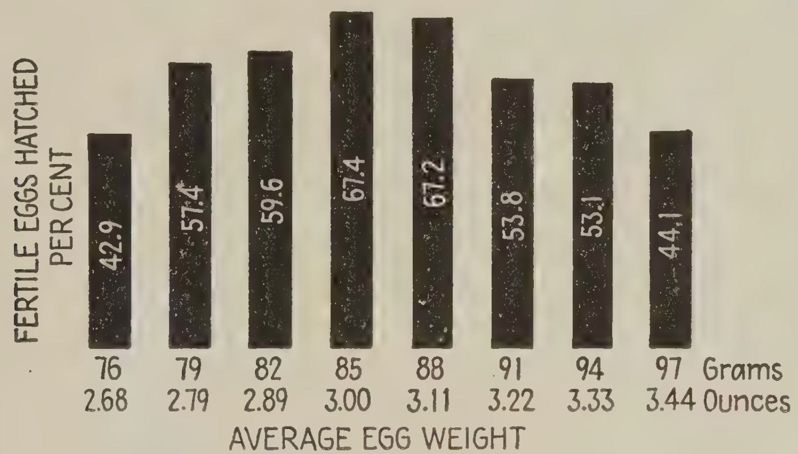


FIG. 59.—Hatchability in relation to egg weight. (*Graph made from data of D. R. Marble and P. H. Margolf, Pennsylvania Experiment Station.*)

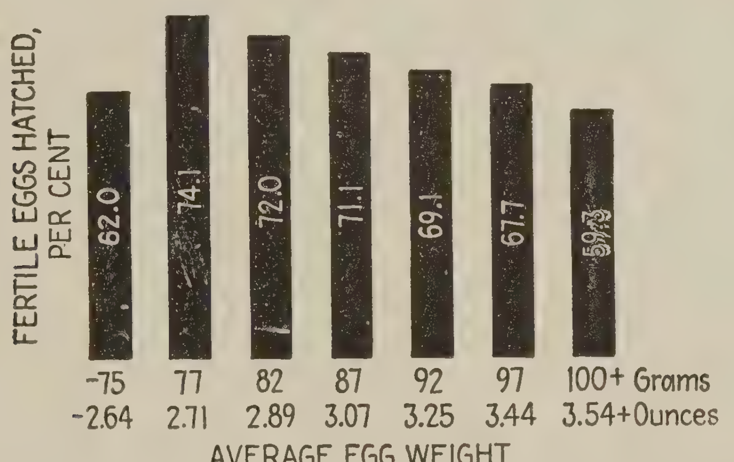


FIG. 60.—Hatchability in relation to egg weight. (*Graph made from data of W. M. Insko, Jr., D. W. MacLaury, and E. A. Baute, Kentucky Experiment Station.*)

interesting to note that in Fig. 59 eggs averaging about 3 oz. hatched the best whereas in Fig. 60 eggs averaging about 2.71 oz. hatched the best. In both cases, however, it is shown that eggs averaging less than about 2.5 oz. or more than about 3.5 oz. per egg showed relatively poor hatchability. It has also been found that among the eggs of any hen, those smaller than the average size of all her eggs are apt to give poorer hatchability than those larger than the average size of all her eggs.

Close inbreeding, if carried on too long, is apt to lower hatchability, as pointed out in the preceding chapter.

Malformed embryos tend to lower hatchability. At the time of hatching the position of a normal turkey embryo is lengthwise of the egg with the head toward the large end and the beak under the right wing, the end of the beak pointing toward the air cell. Embryos deviating from the normal position are called "malpositions." There are many different kinds of malpositions, some occurring much more frequently than others. Embryos with heads to the left instead of to the right and embryos with heads between the thighs apparently rarely hatch. Embryos with heads in the small end of the egg, even when the heads are turned to the right, show much lower hatchability than embryos in the normal position. Eggs incubated in a horizontal position are apt to have more embryos with heads in the small end of the egg than eggs incubated with the large end up during the first 24 days, as mentioned previously.

The malposition, head turned to left with beak under or over the left wing, is considered quite important because of its relative frequency of occurrence. Concerning these various malpositions, most hatchery operators can do practically nothing, but the pedigree breeder should determine whether or not certain malpositions occur in some families more than in others. Evidence has been secured indicating that the malposition in which the head is turned to the left with the beak under or over the left wing is inherited. Some of the other malpositions may also be inherited. Turkey breeders, therefore, should examine dead embryos to identify sires and dams producing them. High hatchability of turkey eggs is so important, because of the relative cost of hatching eggs, that the turkey breeder should do everything possible to eliminate any factor that lowers hatchability.

5. Judging Baby Poults

Baby-poult shows have become quite a prominent feature in many sections of the country and are a splendid means of stimulating interest in the production of poults of good quality. At these shows the poults are judged by the score-card method, a sample score card being outlined in Table 19. For the most part, poults are judged on the basis of vigor, condition, uniformity of size, trueness to color, and uniformity of color.

TABLE 19. SCORE CARD FOR JUDGING BABY POULTS
(Iowa College of Agriculture)

Item	Score
Sturdiness and activity	20
Perfection of development*	20
Uniformity of size	15
Trueness to color for variety	15
Uniformity of color	15
Weight before feeding†	10
Apparent breed type	5
Total score	100

* A well-healed navel is very important.
† An entry of 10 poults should weigh at least 21.2 oz. or 600 g.

6. Securing Poults from a Hatchery

During recent years there has been an increasing tendency for turkey growers to purchase poults from hatchery operators. The quality of poults produced by hatcheries determines to a considerable extent the results secured by those who purchase the poults.

Before deciding where to place your order for poults, find out as much as possible about the kind of selection and breeding program that is being carried on by the hatchery operator. Find out if a pullorum-testing program is being carried out in the flocks from which the hatchery operator secures his eggs. Always remember that good poults cannot be secured from poor eggs.

Securing Poults from Flocks Tested for Pullorum Disease. Pullorum disease is not inherited but may be communicated from the dam to her poults through the egg, as pointed out previously. The organism that causes the disease frequently becomes localized in the ovary of the female breeder and may be present in the egg when it is laid. When infected eggs are incubated, the poults from which they hatch may be infected and may suffer excessive mortality. It is for this reason that turkey breeding flocks should be tested at least once every year in order to determine whether or not any of the birds in the flock harbor the organism. The method of conducting the test to identify pullorum-disease carriers, which are known as "reactors," is described in Chap. 6. There are three classes of the pullorum-testing program for flock owners and hatchery operators carrying on poultry-improvement work under the provisions of the National Turkey Improvement Plan.

Flocks may be recognized as U.S. Pullorum-controlled, U.S. Pullorum-passed, or U.S. Pullorum-clean, depending upon the per cent of reactors or absence of reactors at the time the test is conducted.

Only the major features of the three classes can be discussed here. Complete segregation of turkeys from chickens on any farm and complete segregation of turkey and chicken eggs and poults and chicks in the hatchery is most desirable. In the case of all three classes, toms and hens used as breeders must be at least 4 months old before being tested. All reactors to the test must be disposed of in a manner satisfactory to the official state agency, the organization in each state which has supervision of breeding and pullorum work. All breeders remaining after removal of reactors must be leg-banded or wing-banded.

U.S. Pullorum-controlled Flocks. Each flock of breeders must contain less than 2 per cent reactors, the last test being made within 6 months immediately preceding the date of the sale of hatching eggs, poults, or breeding stock from such flock. A flock containing 2 or more per cent reactors on the first test should be retested at intervals of not less than 30 days until it contains less than 2 per cent reactors.

U.S. Pullorum-passed Flocks. Each flock of breeders must contain no reactors upon the completion of the test made at least 6 months prior to the date of first sale of hatching eggs, poults, or breeding stock from such flock. Two provisions are made, however, for turkey breeders maintaining a number of breeding pens, one or more of which may contain one or more reactors at testing time mentioned above. The first provision requires that any pen containing a reactor be sold for market purposes or segregated for fattening for market and all pens containing no reactors be retested not earlier than 3 weeks, this test again showing no reactors. The second provision requires the immediate removal from the premises of all individual reactors, and all pens containing any reactors must be retested at intervals of not less than 30 days until no reactors are found in any pen, and the entire breeding flock must be retested 14 or more days after such negative test and again must contain no reactors.

U.S. Pullorum-clean Flocks. Each flock of breeders must contain no reactors on the first or any subsequent test made within 6 months immediately preceding the date of first sale of hatching eggs, poults, or breeding stock from such flock. A flock previously recognized as U.S. Pullorum-clean but which by the test for the current breeding season is found to contain not more than 0.5 per cent reactors (1 reactor per 200 birds in the flock), with a maximum of 6 reactors in the entire flock, may still be classified as U.S. Pullorum-clean providing no reactors are present when all turkeys used as breeders are retested not earlier than 30 days nor later than 6 weeks after the first test.

7. Shipping Baby Poults

When the hatch is completed and all poults are "fluffed out," cull them thoroughly. Poults lacking in vigor, poults with improperly healed vents, and poults that are otherwise defective should never be shipped to a customer. In fact, a good rule to follow is not to ship any poult to a customer that you would not want to keep for yourself. A hatchery operator should take pride in the quality and condition of the poults he ships to his customers.

Poult shipping boxes usually consist of four compartments, each of which accommodates from 15 to 18 poults, depending partly on their size but more on the season. In cold weather a few more poults may be placed in each compartment than in hot weather. According to the season of the year, the proper ventilation of poult shipping boxes is accomplished by punching holes (already provided for by perforation at time of manufacture) in the top and in the sides of the box as follows:

Temperature, °F.	Number of holes to be punched in top of box	Number of holes to be punched in sides of box
30	0	2
40	0	4
50	0	6
60	3	8
70	6	8
80	10	8

Poults are shipped by truck, express, parcel post, and air mail. According to regulations of the United States government, baby poults should reach their destination within 72 hr. from the time they were hatched.

Shipping poults considerable distances affects shrinkage and may affect mortality during shipment, especially if a number of transfers are made before the poults reach their destination. In order to give best results, poults should not be over about 60 hr. old from the time they are hatched until they are placed under the brooder and fed. When the poults are received, do not leave them in the shipping boxes too long, especially in a warm room or in a brooder house.

SUMMARY

1. Collect hatching eggs in wire baskets every 2 hr. and store them in a cool room.

2. Do not hold hatching eggs over 10 days for best results in hatching.

3. Early-hatched poults grow faster than late-hatched poults.

4. Chicken or turkey hens used for incubating turkey eggs may be responsible for the poults hatched becoming infected with either the pullorum or blackhead disease.

5. In section-type or gravity-ventilated incubators, maintain a temperature of 100.5°F. the first week, 101.5° the second week, 102.5° the third week, and 103° the fourth week. In cabinet-type or forced-draft incubators, maintain a temperature of 99.5°F. throughout the 28-day incubation period, or during the last 4 days maintain a temperature of 100.5°F., depending upon the make of the incubator used and the section of the country in which you live.

6. Maintain a relative humidity of about 60 per cent during the first 24 days and about 70 to 74 per cent during the last 3 days. During last 4 hr. decrease humidity slightly.

7. Turn the eggs at least five times daily.

8. Fumigate incubator against pullorum disease.

9. Hatchability tends to be lowered if any of the following kind of eggs are set: very small, very large, thin-shelled, poorly shaped, and those with chalky-white porous shells.

10. Before ordering poults from a hatchery, be sure the hatchery operator is carrying on a sound breeding and pullorum-testing program.

4. Brooding and Rearing Turkey Poults

HAVING secured poults, whether you hatched them yourself or bought them, you naturally want to raise as many of them as possible to marketing age. The number raised per 100 started and their quality at marketing time are influenced considerably by the brooding and housing conditions provided and by the management methods employed. If you have poults of superior quality, there is no reason why you should not raise the great majority of them if you follow methods of brooding and rearing that have proved satisfactory, as outlined in this chapter.

The first step in successful brooding is to provide sanitary conditions. For best results it is absolutely necessary to *raise poults entirely separate from all ages of chickens and from adult turkeys.* Chickens and adult turkeys may harbor organisms that cause pullorum disease and blackhead, the latter being one of the worst diseases from which growing turkeys suffer. Reasonably sanitary conditions cannot be maintained for the poults if they mix with other birds. In addition, the brooding quarters the poults occupy must be kept clean and the range area must be relatively free of the blackhead organism. Brooding and rearing poults will be presented in connection with the following activities:

1. Making the Start
2. Brooding Poults with Hens
3. Brooding Poults Artificially
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1. Making the Start

Most turkeys are marketed just prior to Thanksgiving and Christmas, although during recent years the sale of turkeys for celebrating Washington's birthday has increased considerably. Consumer demand for fresh-killed turkeys during the late summer and early fall has also steadily increased. In order to supply most markets, turkeys should be ready to market about 2 or 3 weeks prior to the time the turkeys are purchased by consumers.

Depending upon the variety kept and methods of management, it takes about 24 to 28 weeks to have turkeys in prime condition for market. Hens are usually ready for market about 2 weeks earlier than toms. Start poults, therefore, in time to have well-finished birds for the particular market you wish to supply. Remember that early-hatched poults usually grow faster than late-hatched poults. In fact, temperatures prevailing during the latter part of June and during July in many parts of the country tend to retard growth.

2. Brooding Poults with Hens

If you raise less than 50 poults each year, you could use either chicken or turkey hens, providing they have been found to be free of pullorum disease. A chicken hen will accommodate about 13 poults and a turkey hen about 20. A-shaped coops, each about 4′ × 5′, may be used. Do not nail the board floor to the sides. Figure 61 shows numerous A-shaped coops in an alfalfa field, a method commonly employed several years ago but now superseded by the more economical method of brooding large numbers with artificial brooders.

Confine poults to the coop, with the hen, for the first 2 or 3 days. Thereafter, on fine days as soon as the grass is dry in the morning allow the poults outside, although it would be better to provide a small wired yard in front of each coop so that the poults will not stray too far away from the coop. Move the coop a few yards forward every 2 or 3 days to prevent the soil from becoming con-

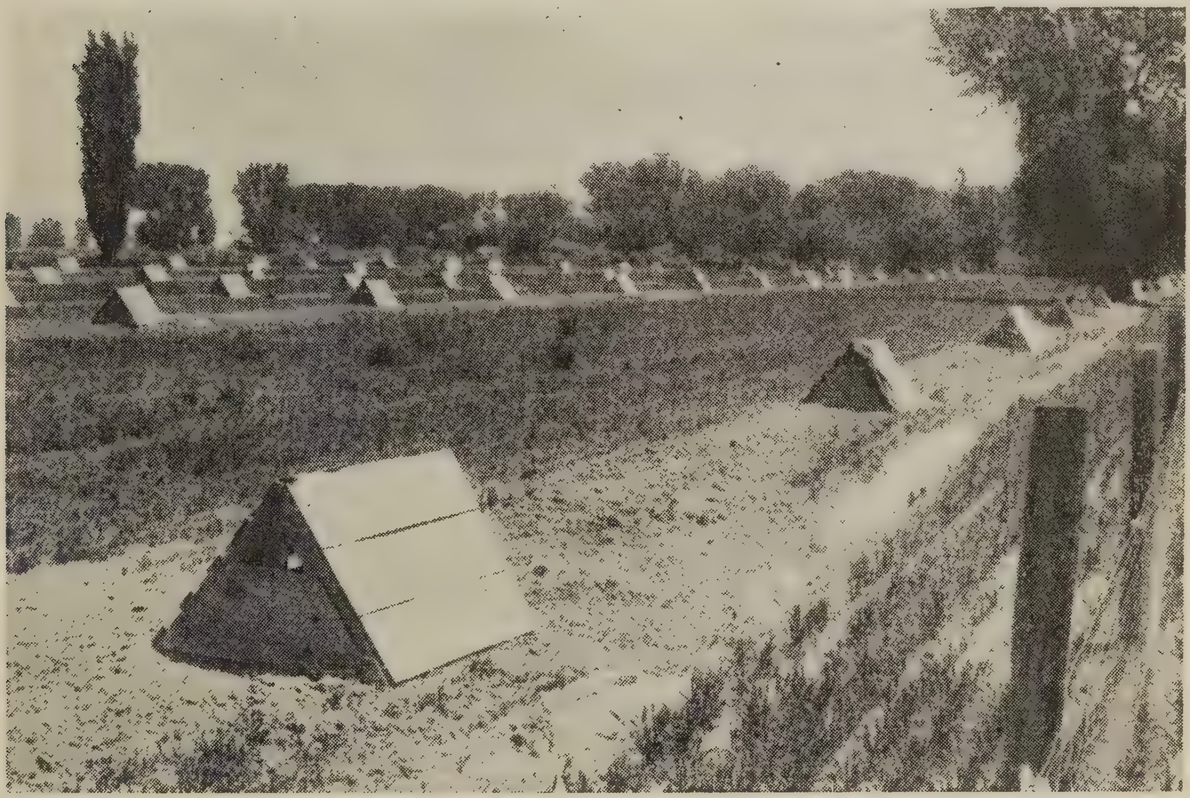


FIG. 61.—Brooding poults in large numbers with turkey hens confined to coops was practiced extensively years ago but has given way to more modern and economical ways. (*L. E. Cline, Nevada Extension Service.*)

taminated. Watch the poults carefully, especially in rainy weather and particularly if the grass or alfalfa is 4 or 5 in. high. After the poults are fairly well grown, the hen may be allowed outside the coop to forage with her brood.

3. Brooding Poults Artificially

If you intend to raise about 100 or more poults, artificial brooding offers several advantages over natural brooding: (1) the danger of spreading disease is greatly reduced; (2) you can start poults at any particular time without having to wait for hens to go broody; (3) you can start with a larger unit each time and thus have a more uniform flock at marketing time; (4) less time and labor are required per 100 poults, even when as few as 200 or 300 poults are raised, to say nothing of raising several thousand.

Deciding on a Brooding and Rearing System. You have a choice of any of the following methods of brooding and rearing poults: (1) brooding poults on the floor with brooders of the conventional type to about 8 weeks and then transferring the poults to range; (2)

FIG. 62.—Thoroughly cleaning the brooder house means scraping the floor very clean and then scrubbing the floor with boiling-hot lye water. (*Allied Mills, Inc.*)

brooding by the same method but providing a sun porch attached to the brooder house, keeping the poults confined to the brooder house and sun porch for about 10 or 12 weeks or transferring them at that time to the range; (3) brooding by the conventional floor method to about 8 weeks and then transferring the poults to a gravel yard; (4) brooding in batteries for 3 or 4 weeks, then floor brooding to about 8 weeks, followed by range rearing; (5) battery brooding for 3 or 4 weeks, followed by floor brooding to about 8 weeks, then confining to brooder houses and sun porches.

Variations from these methods are practiced by some turkey raisers but for the most part the majority of turkey raisers use method 1 or 2. Other methods have their proper place, however, as will be discussed later.

Starting with a Clean Brooder House. Whichever method you choose to brood and rear poults, you know that however well fed and managed they are they will not make good growth and mortality may be excessive if they are subjected to the ravages of various disease organisms. Few things are as important in keeping diseases under

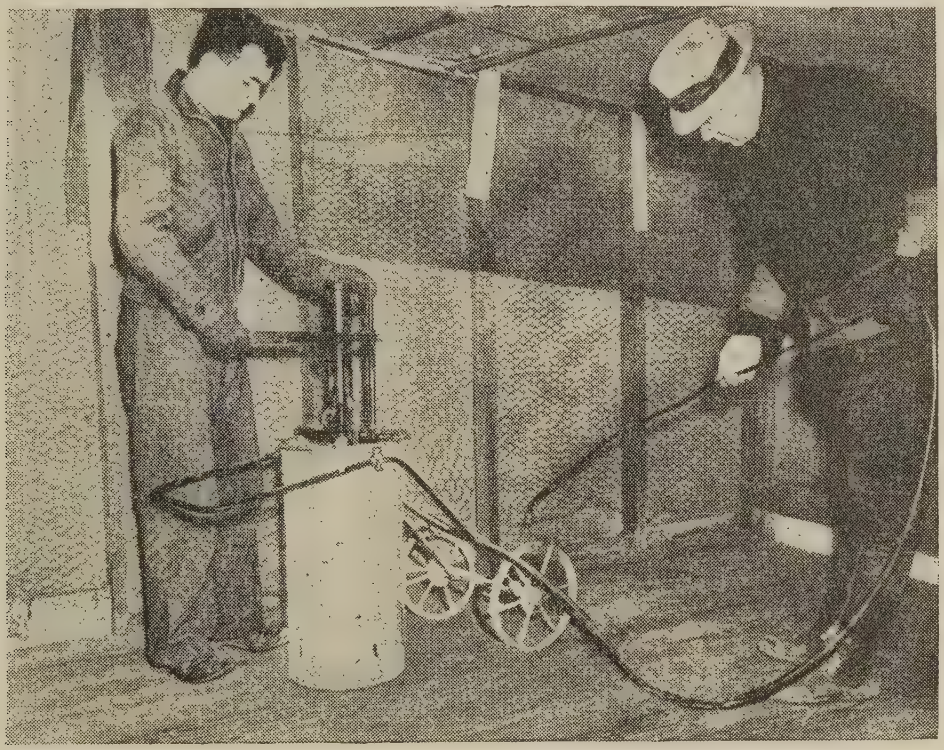


FIG. 63.—After the brooder house has been thoroughly cleaned and scrubbed, disinfect it just as thoroughly. (*Turkey World.*)

control as sanitary brooding quarters and equipment and sanitary range, if the poults are reared on range.

Disease organisms lurk in cracks and crevices and some of them may cause trouble after several months of hiding. Before poults are put in the brooder house clean it out, scrape the floor, and scrub the walls and floor. Be sure the floor is thoroughly cleaned, including cracks and crevices, because disinfectants lose much of their power when they come in contact with organic material. For scrubbing the floors and walls use boiling-hot lye water, 1 lb. of lye to 15 gal. of water. After the house has been scrubbed thoroughly, allow it to dry.

Next, spray the interior with a good disinfectant, preferably with a pressure pump, as shown in Fig. 63. Any one of the three following disinfectants can be used: (1) a 5 per cent solution of cresol mixed with water at the rate of 1 pt. to 2½ gal. of water; (2) crude carbolic acid mixed with water at the rate of 7 oz. per gallon of water, taking care not to get crude carbolic acid on the hands or clothing; (3) any of the standard coal-tar dip solutions.

A brooder house with its interior whitewashed is brighter and always looks cleaner than one not whitewashed. To make an effective disinfectant whitewash, dissolve 5 lb. of alum and ½ lb. salt

FIG. 64.—Be sure to have the brooder at the proper temperature before placing the poults under it and put every poult under the hover so that it will know where to go to get warm. (*Turkey World.*)

in 3 gal. hot water and dissolve 25 lb. of quicklime in 4 gal. of hot water and then add the two mixtures together. To 7 gal. of the double mixture add 2½ lb. of cement and ½ can of lye.

Clean all poultry utensils, including watering equipment, and disinfect regularly.

Allow at least 2 years to elapse before turkeys are ranged on the same ground again or on ground previously occupied by chickens.

Choosing a Type of Brooder. There are several different types of brooders, which vary in size, design, and kind of fuel used to supply heat. Since they are described in considerable detail in "Successful Poultry Management" and some other texts listed in the Appendix, only a few comments are necessary here. Allow about 10 to 12 sq. in. floor space per poult under the canopy of the brooder. Probably most turkey raisers use the coal-burning colony brooder, although electric brooders are apparently gaining in popularity. The hover of an electric brooder should be well insulated, there should be an 8-in. curtain at the edge of the canopy, and the brooder should be equipped with a fan to ensure adequate ventilation. Placing the electric brooder on a hardware-cloth platform is a good way of providing

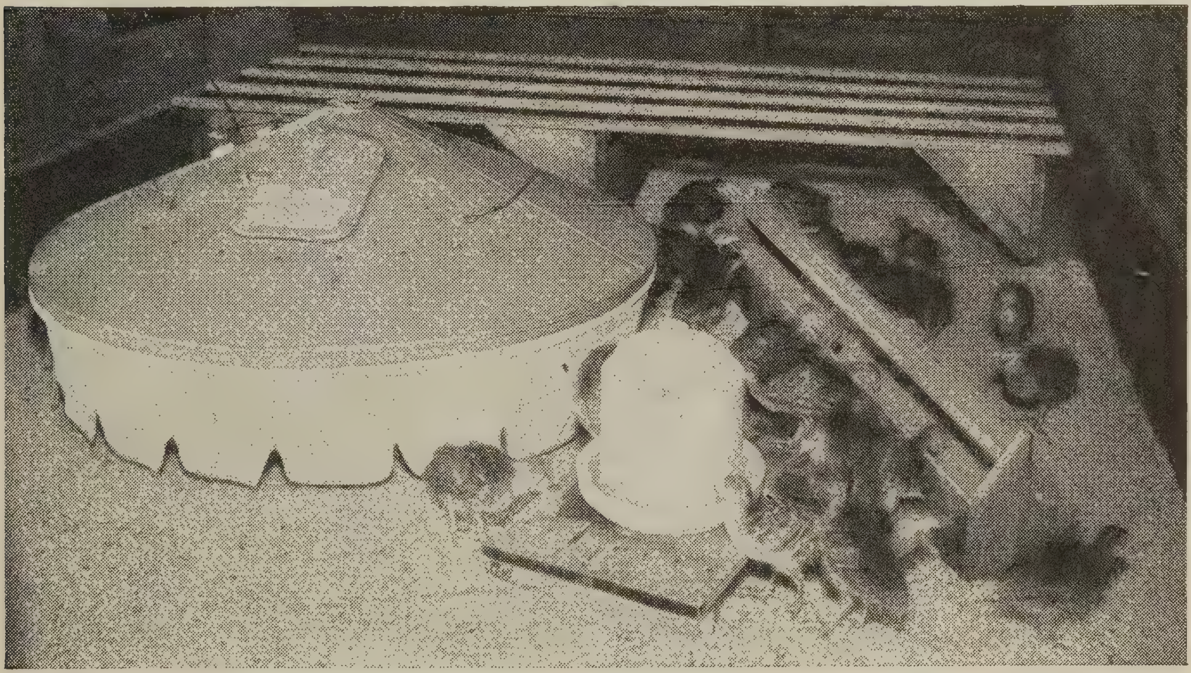


FIG. 65.—Feeders and water containers should be convenient for the poults. (*V. S. Asmundson and T. H. Jukes, University of California.*)

good ventilation under the brooder. Use ⅜ in. mesh of 18 gauge. Gas-burning and oil-burning brooders are easier to operate than coal-burning brooders, but many turkey growers do not have access to gas and in some sections fuel oil is relatively more expensive than coal and precautions must be taken against creating fire hazards when using oil-burning brooders. Wood-burning brooder stoves are economical where green hardwood is available and are relatively easy to operate but are inclined to overheat a brooder house of limited size, especially in sections of the country where warm weather prevails in April and May. Feather brooders are used to some extent, but supplemental heat must be provided by heating the entire room. Hot-water brooders of the continuous system are sometimes used by commercial turkey growers who raise several thousand turkeys annually.

Battery brooders are used by some of the larger growers for the first 3 or 4 weeks, after which the poults are transferred to floor brooding with any of the types of brooders mentioned above. This combination method of brooding means relatively more investment of money in brooding equipment but may be justified in the case of a large turkey enterprise, because with large numbers the problem of management in brooding and feeding during the first 3 or 4 weeks is under better control. Also, the poults are kept off of the droppings.

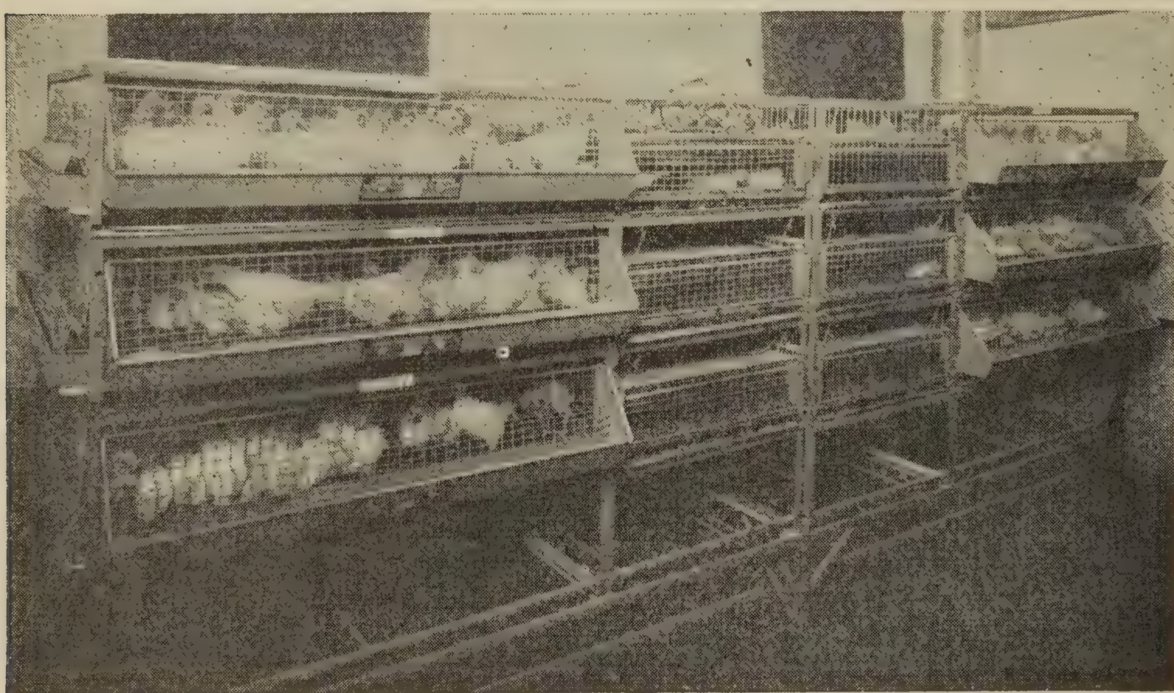


FIG. 66.—Starting poults in batteries. (*The Beacon Milling Co., Inc.*)

On the other hand, there is danger of the poults' hocks catching in the wire floor of the battery. Poults grow very fast and the number kept in each section of the battery must be reduced about 50 per cent every two weeks or overcrowding is liable to occur. The battery-brooder room should be maintained at about 70°F. and the brooder compartment of each section of the battery should be kept at about 97°F. for the first week and reduced about 5° weekly until the poults are transferred to the floor. A relative humidity of about 65 per cent should be maintained in the battery-brooder room.

Maintaining Good Brooding Conditions. Since most turkey raisers use colony brooders in the floor-brooding method, they should know the conditions necessary for securing best results.

Maintain Correct Temperature. Start the brooder 2 or 3 days before the poults are to be placed under it to make sure that a temperature of 95°F. is maintained at the edge of the canopy or hover, just above the poults, except that in the case of electric brooders the temperature under the hover may go to about 98°F. for the first few days because the electric brooder does not heat the room. After the first day or two, depending upon the season, lower the temperature about 0.5° daily or about 5° weekly. Poults need heat from the brooder during about the first 6 to 10 weeks, depending upon the season.

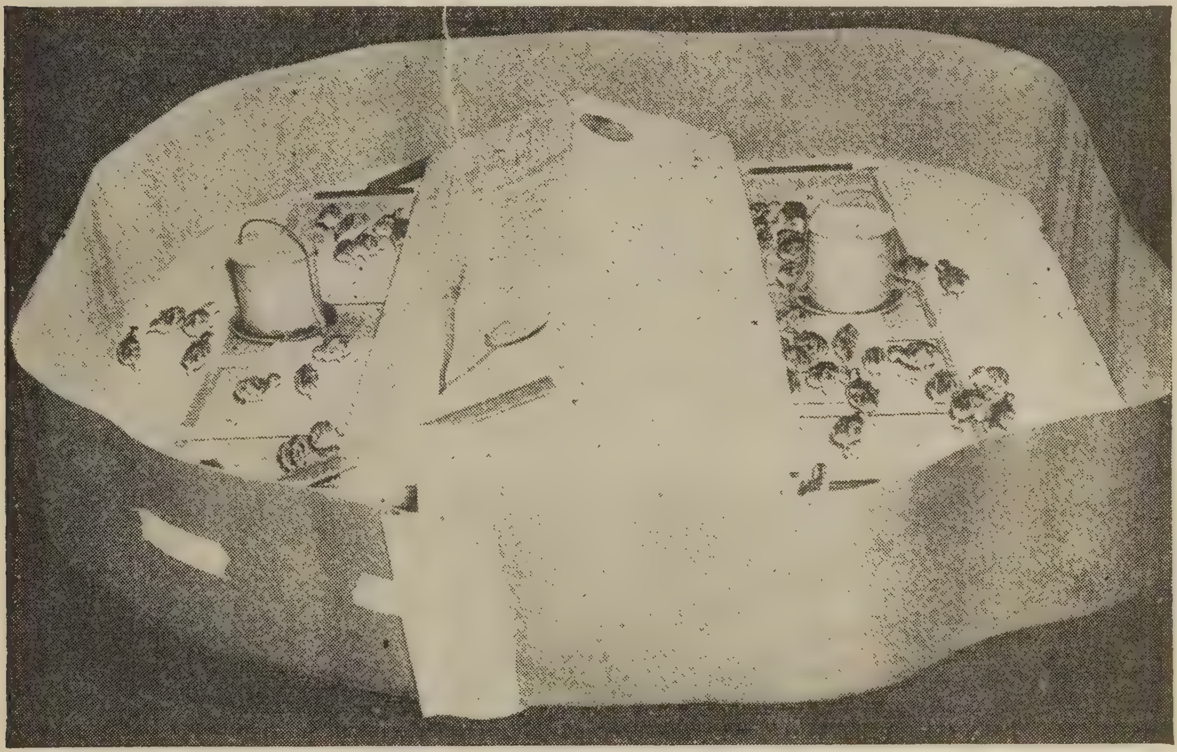


FIG. 67.—Using a guard around the brooder the first few days is very important. It breaks any draft and keeps the poults near the source of heat. (*Turkey World.*)

If you are an experienced turkey raiser, however, you will be guided by the apparent comfort of the poults from day to day and from night to night. Visit the brooder house the first few nights to make sure that the poults are sleeping comfortably around the edge of the hover or the canopy at "bedtime." If many of the poults are outside of the hover the temperature is too high and if they are huddled around the center of the brooder the temperature is too low. Always keep in mind that the first week of brooding is most important and if you watch your poults at night you can make the necessary adjustments to maintain good brooding conditions.

Use a Guard. Put a guard around the brooder, about 18 to 24 in. away from the edge of the hover or canopy, to keep the poults near the source of heat and to prevent them from piling up in the corners of the house. If you are using an electric brooder, be sure to have the guard touch one edge of the hover so that the poults will find their way to the heat under the hover. After the first 3 or 4 days move the guard further away each day, until after about 10 days it can be dispensed with.

Use Good Litter. Chopped alfalfa hay, clean straw that is not too finely cut, crushed corncobs, dried sugar-cane pulp, peat moss, and coarse sand or gravel make good litter. Cut straw mixed with crushed corncobs helps to keep the litter loose and spongy. However, for the first few days put clean sacks or rough paper toweling over the litter to prevent the poults from eating the litter and to teach them to eat the feed, which should be spread out on eggcase flats or any flat board or dish that has a rough surface. Never use smooth paper or any other material with a smooth surface to cover the litter.

Keep the litter in as dry a state as possible throughout the brooding period, because certain disease organisms spread more rapidly in damp than in dry litter. Stirring the litter every day helps to keep it in a dry state. Adding a little fresh litter every few days also helps to keep the litter dry. How frequently to renew the litter in the brooder house depends on (1) how often it is stirred and new litter added; (2) the number of poults in proportion to the floor space of the house; (3) the type of brooder used; (4) the ventilation of the brooder house; (5) the laxativeness of the diet fed to the poults; (6) weather conditions.

Prevent Crowding. Poults are much more apt to crowd and pile up in the brooder house than chicks, especially if brooding conditions are at all abnormal. Excessive variation in the temperature under the brooder, fright, and strange buckets or other objects in the brooder house are all conducive to crowding and piling up, sometimes resulting in high mortality.

In order to prevent crowding as much as possible, be sure that an even temperature is maintained under the brooder and do everything possible the first few nights to encourage the poults to seek the source of heat under the brooder. Using a 10-watt bulb located about 5 ft. above the hover encourages the poults to go under the hover, the darkest place in the brooder house. Turn the light on before dusk and leave it on all night.

Put wire, cardboard, or boarding across each corner of the brooder house or pen to prevent the poults from piling up in the corners.

4. Providing and Using Brooder Houses

Brooder houses for poults are for the most part of the same type and style of construction as for chickens and vary from a small colony house to a long continuous house consisting of numerous pens.

Providing a Colony House. For most turkey raisers a 10′ × 12′ colony house is satisfactory because it will accommodate 150 poults up to 8 weeks, this being about as many poults as should be brooded as a unit for best results in growth and low mortality. It is true that in California and some other states larger numbers are brooded together as a unit, sometimes as many as 200 or even 300 per house if a few thousand turkeys are raised annually, but from the standpoint of securing uniform rate of growth and keeping mortality at a minimum, about 150 poults per unit or brood gives the most satisfactory results. Allowing for some mortality, a 10′ × 12′ house for 150 poults provides about 1 sq. ft. of floor space per poult, which is about right for best results during the brooding period. By the time poults are 6 months old they need about 6 sq. ft. of floor and sun-porch space per bird if they are raised in semiconfinement.

Details and specifications for building brooder houses are given in "Successful Poultry Management" and need not be repeated here. The plan of a 10′ × 12′ colony brooder house on skids is shown in Fig. 68, this type of house being satisfactory in most parts of the country. Write to the poultry department of your state college of agriculture for plans and specifications of houses suitable for the section of the country in which you live. For a list of colleges see the Appendix.

Providing a Continuous House. Long brooder houses, with a rear alley 4 ft. wide, divided into numerous brooding units are used by many commercial turkey growers. These houses are usually about 20 ft. wide and face the south or southeast and have a sun porch attached to the front of the house. Some turkey growers use brooder houses about 36 ft. wide with the long axis north and south and with a 4 ft. alley running lengthwise through the center of the house and sun porches attached to the east and west sides. Long houses save labor in caring for large numbers of poults.

Practically all these continuous houses have concrete floors. Wooden or wire platforms made of 0.4″ × 0.4″ mesh are frequently placed under the hover area, especially if electric brooders are used, to overcome dampness and prevent the poults from becoming chilled,

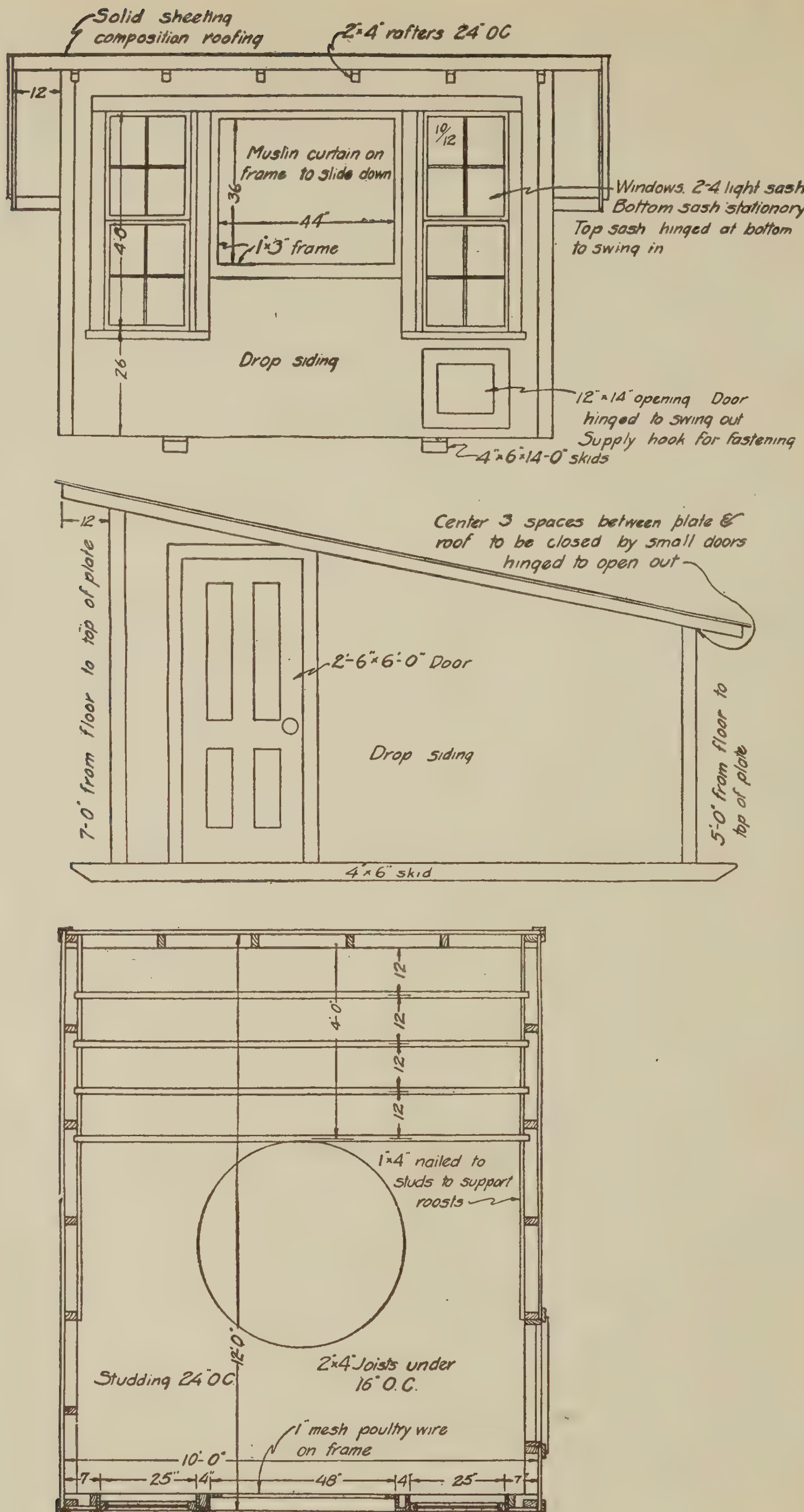


FIG. 68.—A 10′ × 12′ portable colony brooder house suitable for starting 150 poults. (*M O. North, Wyoming Experiment Station.*)

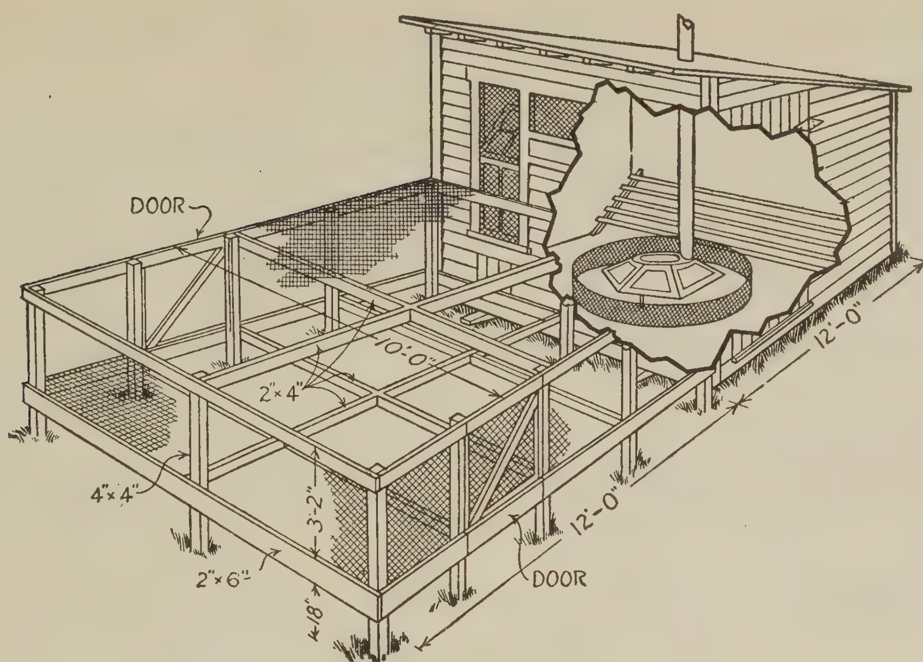


Fig. 69.—Colony brooder house with coal-burning brooder stove and sun porch in front. (*Turkey World.*)

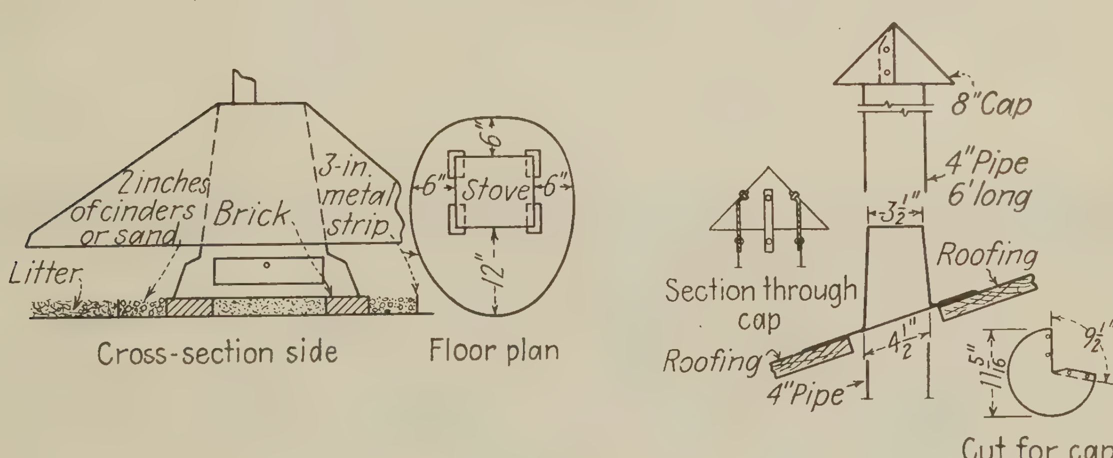


Fig. 70.—Left, arrangement for keeping fire hazard at a minimum with a coal-burning brooder on farm of Thomas Waite, Montgomery County, Pa. The stove is placed on four bricks. A strip of 3-in. galvanized sheet metal is curved around the base of the stove and the enclosed area is filled with 2 in. of sand or cinders, forming a hearth around the stove. The metal strip is 6 in. away from the back and sides and 12 in. away from the front of the stove, thus reducing danger of fire in case live coals are dropped while removing ashes. (*Everybody's Poultry Magazine.*)

Right, a roof jack that prevents rain from leaking around the stove pipe and keeps stove pipe away from roof to avoid danger of roof catching fire. (*W. R. Whitfield, H. L. Wilcke, and W. M. Vernon, Iowa Extension Service.*)

as shown in Fig. 72. Some growers use wire floors of 1-in. mesh over the entire floor area and for the first 3 or 4 weeks of the brooding period lay on top of this wire floor another wire floor of 21 gauge weight 0.4″ × 0.4″ mesh. For the first few days of brooding, clean

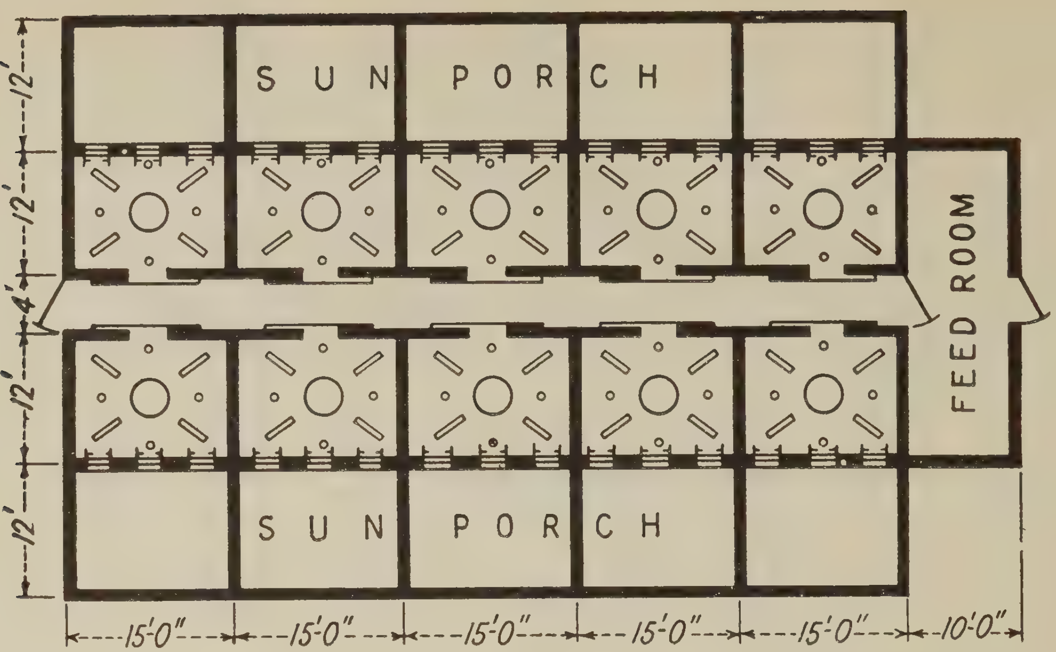


FIG. 71.—A floor plan of the multiple-type house with two rows of pens. Each unit is equipped with stove, fountains, and feeders. Slide doors permit access to the different pens. The feed room should be put on the north end, or in the center when the house is exceptionally long. (*W. R. Whitfield, H. L. Wilcke, and W. M. Vernon, Iowa Extension Service.*)

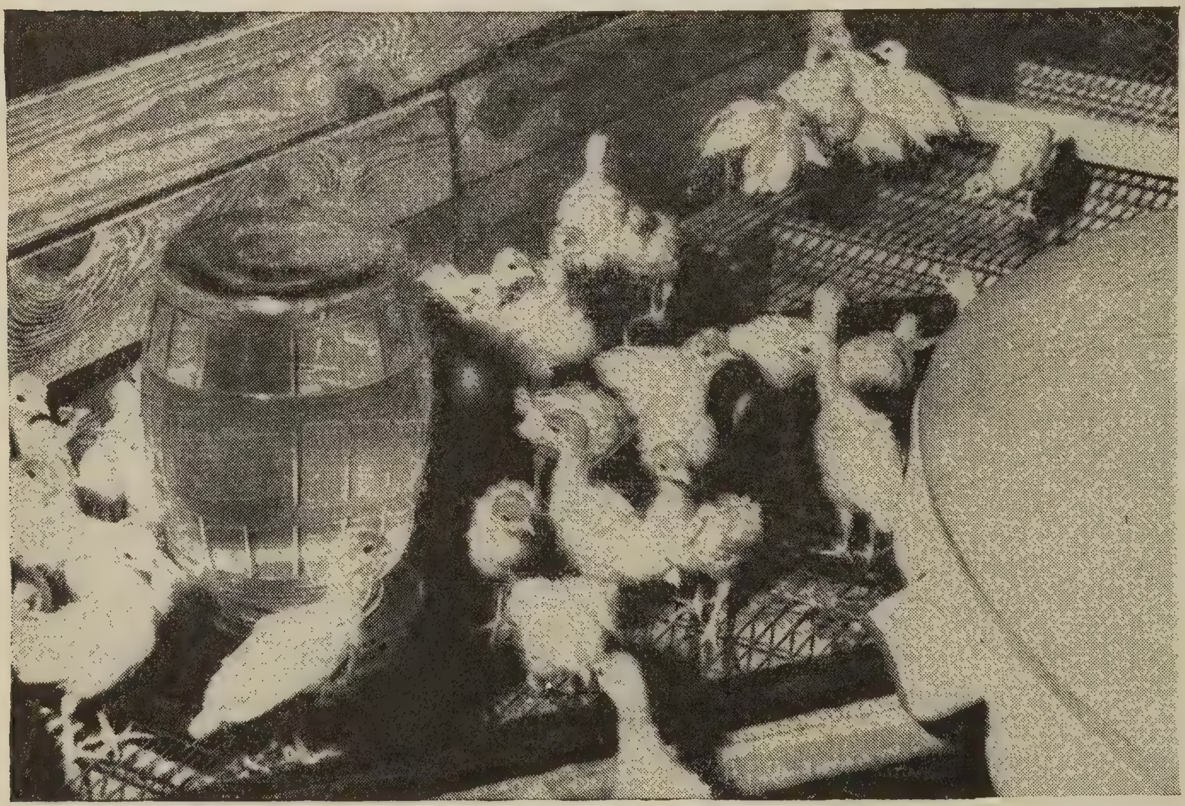


FIG. 72.—A wire floor provides reasonably sanitary quarters and helps to prevent losses from disease, especially coccidiosis and blackhead. (*P. H. Gooding, South Carolina Extension Service.*)

sacks are placed on top of the second wire floor. After about 4 weeks the finer-mesh wire floor is removed, cleaned, disinfected, and stored until needed again.

A wire floor in the brooder house does away with the necessity of providing litter. At the same time, the accumulated manure is likely to smell very strong in warm weather and flies may breed freely. Sprinkling air-slaked lime or spraying 3 per cent cresol over the manure tends to overcome both objectional features. At the completion of the brooding season soak the wire floors thoroughly, scrub them with wire-bristle brushes, and disinfect them.

Whitewashing Brooder Houses. Whitewashing improves the appearance of brooder houses, sun porches, and range shelters and makes the wood last longer.

A good rainproof whitewash is made as follows: (1) dissolve 1 lb. zinc sulphate and 2 lb. salt in 2 gal. water; (2) slake 62 lb. of quicklime in 10 gal. hot water; (3) add mixtures 1 and 2 and to this double mixture add 2 gal. skim milk and 1 oz. alum. To prevent rusting, omit salt if metal is to be whitewashed.

A whitewash that sticks well is made of the following ingredients: Spanish whiting, ½ lb.; glue, 1 lb.; rice flour, 3 lb.; salt, 15 lb.; quicklime, 40 lb. Slake the lime slowly in about 5 pt. of hot water. To the mixture add the Spanish whiting, rice flour, and salt. Dissolve the glue in hot water and add to the mixture. To the whole mixture add 5 gal. water.

Maintaining Sanitary Brooding Conditions. Many of the diseases that cause excessive mortality among poults are filth-borne. Sanitation, therefore, is the best way to combat disease. Among the most effective ways of poviding sanitary conditions during the brooding season are (1) cleaning under the brooder daily; (2) cleaning the brooder house every week, especially to combat coccidiosis, which is discussed in Chap. 6; (3) maintaining a reasonably dry litter; (4) using wire or hardware-cloth floors; (5) placing feeders and water containers on wire platforms. Keep the litter in the brooder house reasonably dry because certain disease organisms multiply rapidly in damp litter.

Providing Roosts Early. Early roosting tends to prevent crowding and piling. If roosts are provided as early as 10 days, the poults tend to sit on them during the daytime but are not likely to use them during the nighttime until they are about 3 weeks old. Place the roosts about 1 ft. above the floor and make them of poles 2 in. in diameter or of $1'' \times 2''$ pieces laid flat or slightly tilted with the upper edge beveled. Put the roosts about 10 in. apart.

Providing Ample Feeding Space and Waterers. The first cardinal principle to remember in connection with mash hoppers and

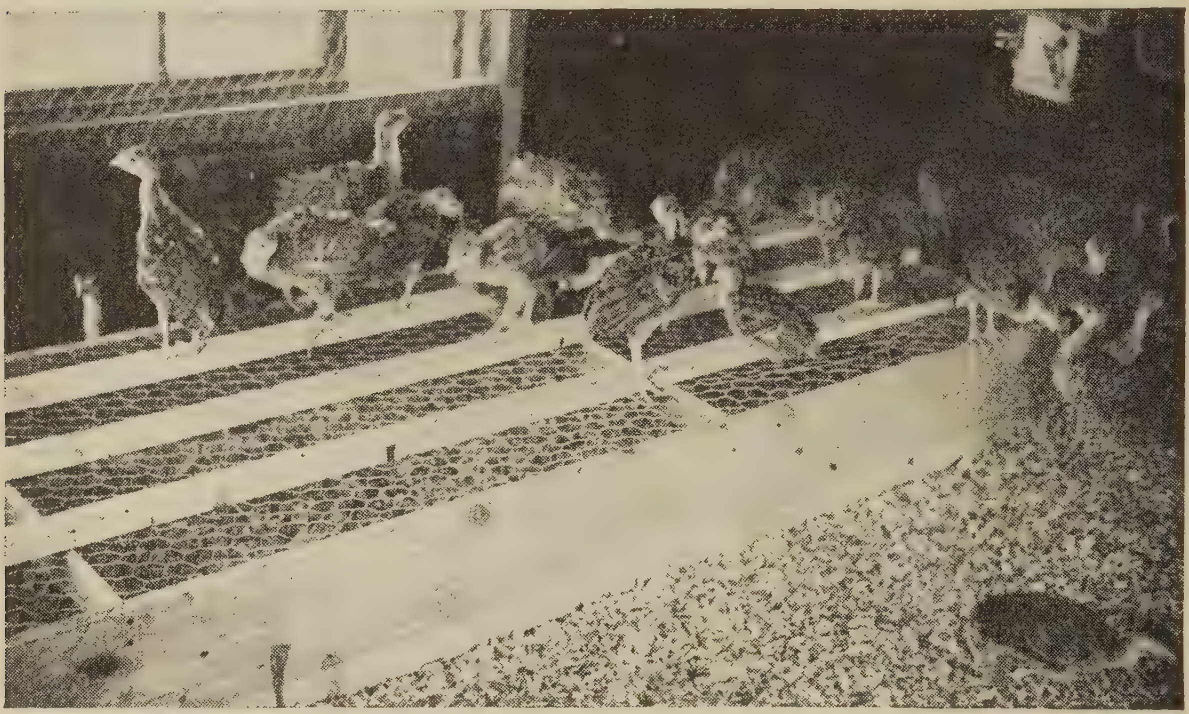


FIG. 73.—Provide roosts early. (*The Beacon Milling Co., Inc.*)

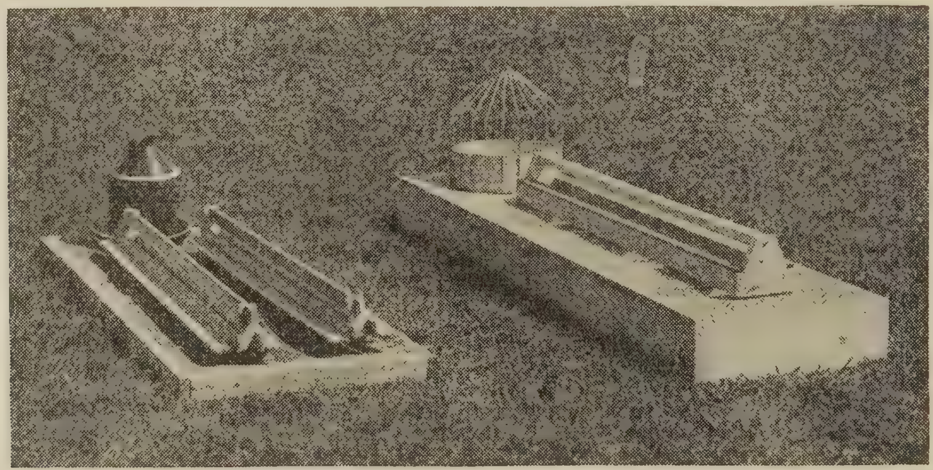


FIG. 74.—Types of feeders and waterers suitable for poults during brooding period. (*T. B. Clark, T. D. Runnels, and E. A. Livesay, West Virginia Experiment Station.*)

watering utensils is that the poults must not be allowed to get their feet into the hoppers and waterers and that feces must be prevented from being deposited in them insofar as possible. Contaminated feed and water promote the spread of disease. The second cardinal principle to remember is that plenty of feed-hopper space and watering capacity must be provided or poults will not grow at a uniform rate.

Open feeders are preferable to those with guards from side to side. For the first week, use shallow feeders made of lath or resawed material 1½ to 2 in. wide and provide three feeders each about 4 ft. long for 150 poults. From the second through the fourth week, use feeders with 2½-in. sides and provide five feeders each about 4 ft. long. From the fifth to about the tenth week, use feeders with 5-in. sides and provide seven feeders each about 4 ft. long. After about the tenth week, use feeders with 8-in. sides and provide nine feeders each about 4 ft. long. For feeders used after the second week stretch a No. 10 or

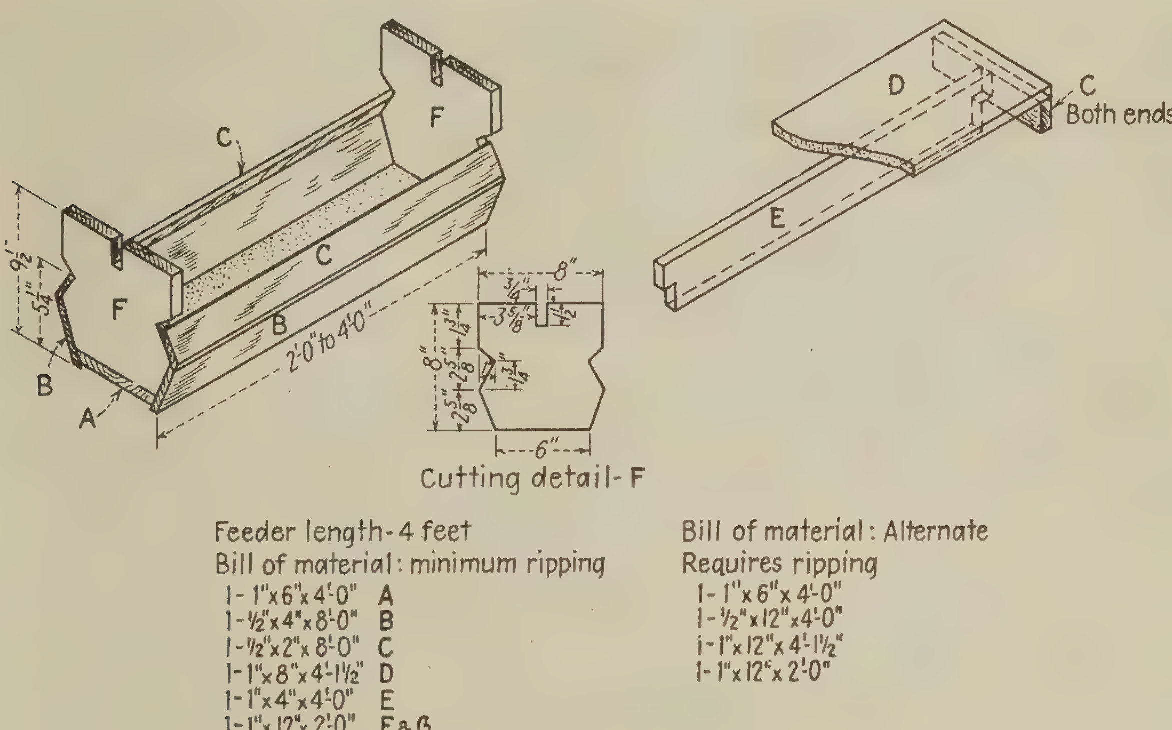


FIG. 75.—Feeder for poults when about 5 weeks old. (*J. H. Claybaugh, Nebraska Agricultural College.*)

12 wire from end to end to serve as a beak cleaner. This tends to prevent feather picking. Build mash hoppers or feeders for use on range on skids so that they can be moved frequently.

Water containers should be simple in design so that they can be cleaned readily and made so that the poults cannot stand on top to foul the water. For the first month, provide six 2-qt. containers, such as Mason jars, for 150 poults. From 5 to about 8 weeks, provide three water containers, each holding 2 gal. From 9 weeks onward, five pails each holding 12 qt., or barrels with troughs attached, may be used or troughs supplied with water from pipes running to the range if relatively large numbers of poults are being raised on range. Carrying water is a backbreaking job, so whenever possible have it piped to the place where turkeys are raised or use a truck or water wagon. Sanitary conditions around watering places are most important. For this reason watering utensils should be placed on wire platforms and proper drainage should be provided for any excess water that may be spilled near the trough or pan.

5. Rearing Poults in Semiconfinement

Experience has taught thousands of turkey growers the fallacy of attempting to raise poults on contaminated soil or allowing them to

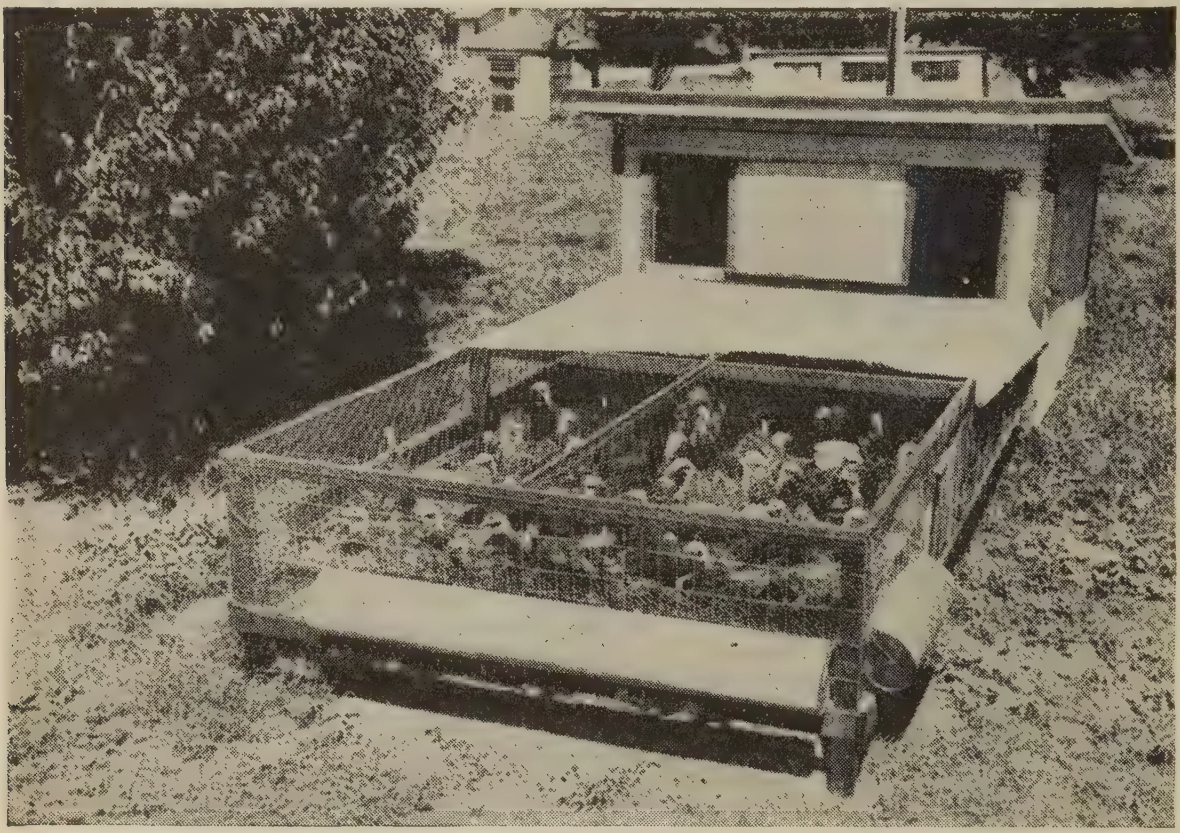


FIG. 76.—Sun porch attached to brooder house gives poults access to sunlight but keeps them out of their droppings and off of contaminated ground, thus reducing losses from mortality. (*Turkey World Experimental Farm.*)

mix with adult turkeys or chickens. Mortality is usually excessive. Experience has also taught thousands of turkey growers that the most effective way of combating excessive mortality is to raise the poults in semiconfinement, confined to the brooder house and sun porch attached to the brooder house or in a yard of limited size that is covered with stones.

Using Houses with Sun Porches. A sun porch attached to a brooder house should be about the same size as the brooder house. Cover at least part, if not all, of the sun porch to give the poults shade

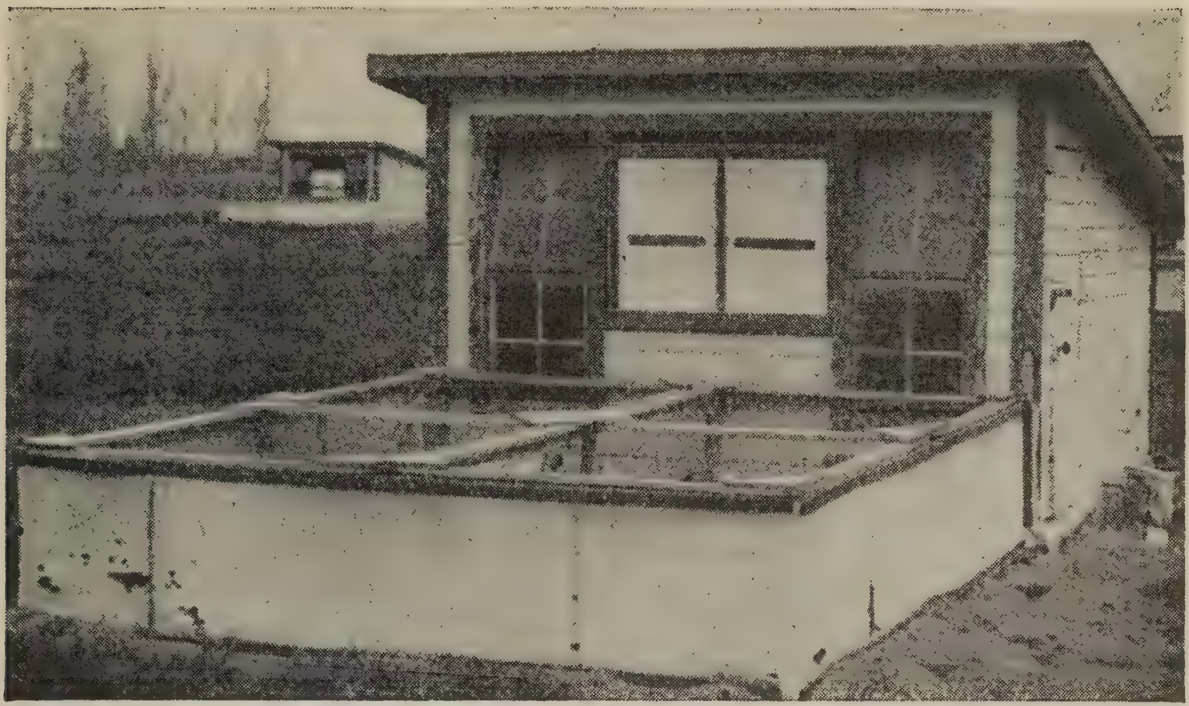


FIG. 77.—Sun porch attached to 10′ × 12′ brooder house with building paper around sunporch as a windbreak. (*M. O. North, Wyoming Extension Service.*)

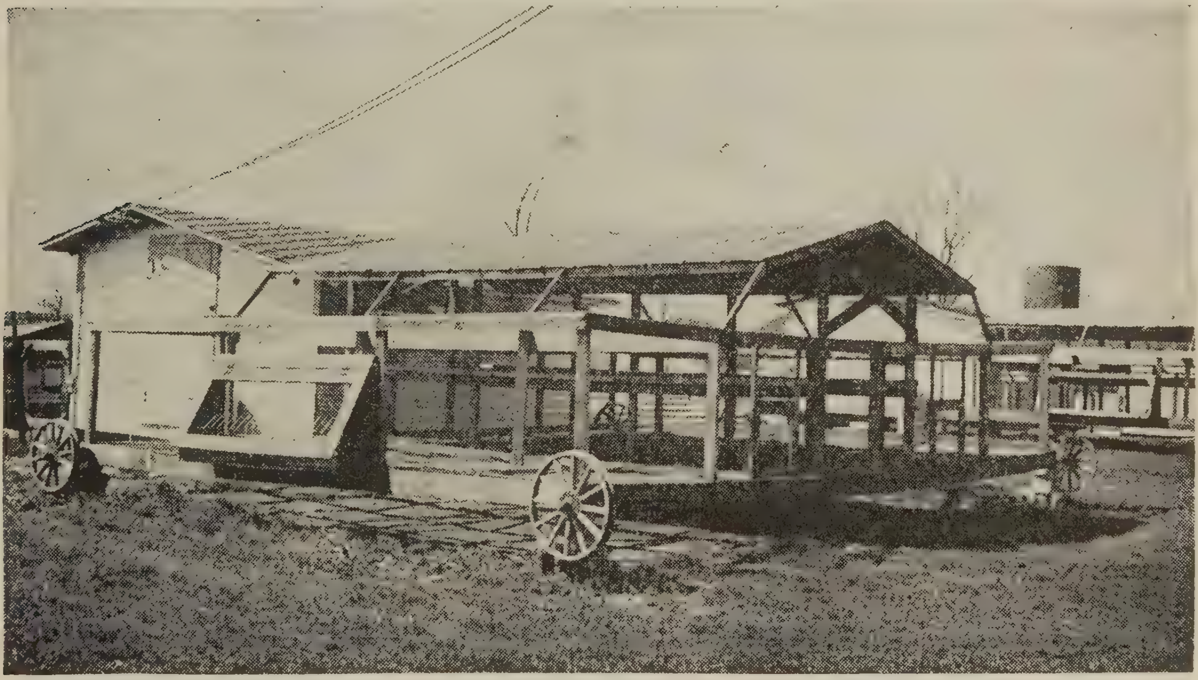


FIG. 78.—Sun porch on wheels for ease in moving. Note feeder attached to side. (*The Beacon Milling Co., Inc.*)

and protection from heavy rains. A sun porch attached to a colony brooder house should be movable so that it can be moved when the colony house is moved, and the floor of the sun porch should be high enough from the ground to permit easy removal of the droppings. A sun porch attached to a continuous brooder house should have the floor at least 2 ft. from the ground. The best arrangement is to locate the brooder house on sloping ground with the sun porch on the lower slope.

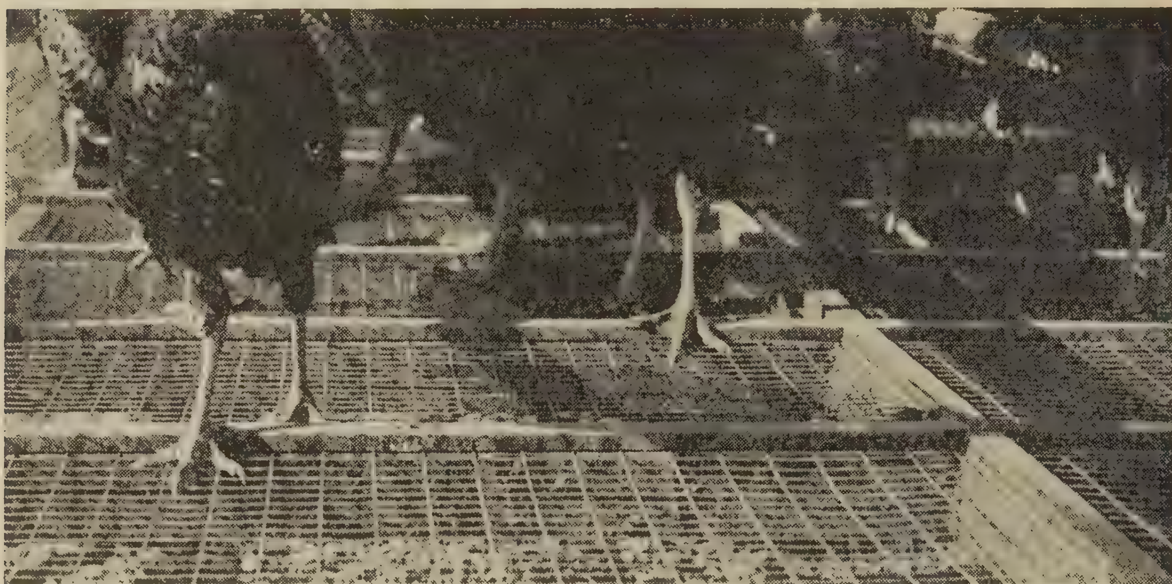


FIG. 79.—Strips nailed over joints of wire floor of sun porch prevent manure from adhering to framework. (*T. B. Clark, T. D. Runnels, and E. A. Livesay, West Virginia Experiment Station.*)

FIG. 80.—Slatted sun porches for turkeys on Leader poultry farm, Pennsylvania. (*H. H. Kauffman, Pennsylvania Extension Service.*)

Place the joists for wire floor 12 in. center to center and put crosspieces 24 in. apart. Use welded wire fabrics of 1″ × 2″ mesh of 16-gauge or heavier wires. Put strips over the joists and crosspieces to prevent manure from adhering to the framework. In order to make the sun porches accessible to poults 2 or 3 weeks of age, lay 3-ft. strips of 1-in. mesh, 19- or 20-gauge wire over the main flooring.

Slatted floors for sun porches are quite satisfactory and usually cost less than wire floors. Use slats 1¼ in. wide and 1 in. thick and space them at least 1 in. but not over 1½ in. apart (see Fig. 80). Poults can be given access to a sun porch with a slatted floor at about 3 weeks of age. Slatted floors for Broad-breasted Bronze poults are much better than wire floors, which are apt to give the birds sore feet.

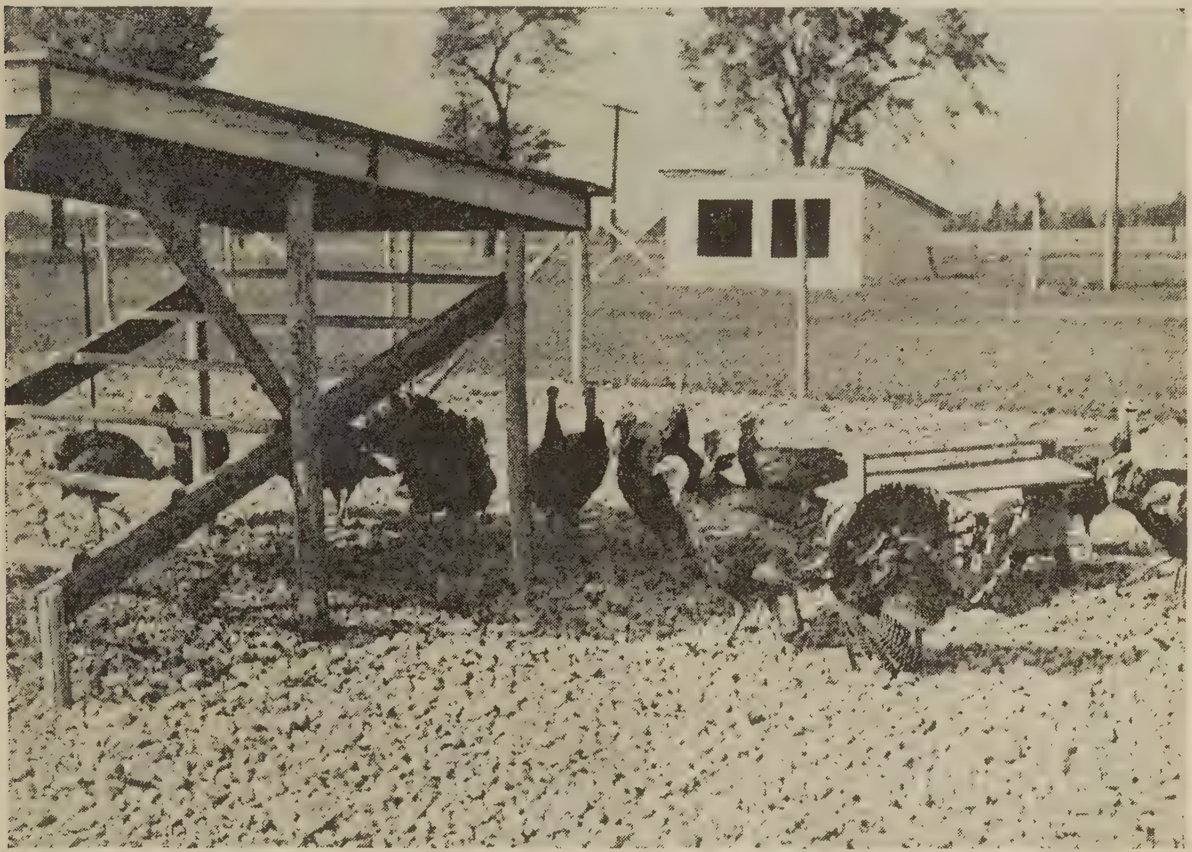


Fig. 81.—A stone yard for raising poults after the brooding period. (*A. Berridge, Lake City Experiment Station, Michigan.*)

Have the top of the sun porch at least 6 ft. above the floor and, if roosts are placed in the sun porch, place them high enough so that poults standing on the floor cannot pick those sitting on the roosts. For the sides and tops, if the tops are not completely boarded over, use woven-wire field fencing with stays 8 to 10 in. apart or, better still, hexagonal mesh in which the mesh is large enough so that snow will not collect.

Using Stone Yards. It is possible to raise turkeys on a limited area providing there is little chance for droppings and organisms of disease to accumulate. Stone yards can be used to good advantage by those who raise about 100 turkeys each year. Place poults in the yards at about 8 to 10 weeks of age. A yard 70′ × 80′ will accommodate about 125 turkeys to maturity. Use round stones about 4 to 6 in. in diameter to a depth of 6 to 8 in., with some 2-in. stones to fill in the top. The layer of stones should be deeper on heavy clay soil than on sandy soil. Good drainage is absolutely necessary and the yard should slope so that all water will drain away and no puddles remain. Since in hot weather the stones get quite hot, a suitable shelter with roosts should be provided so that it can be used by the turkeys during the warmer parts of the day. Remove promptly droppings that accumulate under the roosts. The stone-yard method of rearing turkeys appeals particularly to farmers who have other poultry and to those who have a limited amount of land available for turkey raising. With limited numbers of turkeys it is a good substitute for range rearing.

6. Rearing Poults on Range

Although raising turkeys confined to the brooder house and sun porch has been on the increase, by far most of the turkeys are raised on range after the completion of the brooding period. Poults moved to the range at about 8 weeks of age need protection from the elements and from natural enemies. Roosts within wire enclosures provide some protection against predatory animals, but in most parts of the country a range shelter with a durable roof is essential.

Providing Range Shelters and Equipment. A portable range shelter built on skids, such as shown in Fig. 82, is easily moved so that the poults can be provided with a new range area as often as may be desirable. Make the roof tight to shed all water. Corrugated roofing is satisfactory and economical and should be painted with aluminum paint to deflect some of the heat. Roofing paper over sheathing could be used, providing the sheathing is tight enough to prevent winds from raising the paper. For the sides, use woven wire of 1-in. hexagonal mesh, 18 gauge, or 1½-in. hexagonal mesh, 16 gauge, fastened tightly to exclude dogs and coyotes. For the floor, use 1-in. 14-gauge hardware cloth or 1″ × 2″ 11-gauge electric welded wire or welded-wire floor sections. Have the top of the floor at least 1½ ft. above the ground.

Make the roosts of poles at least 2½ in. in diameter or of 2″ × 4″ pieces laid flat with the top corners rounded slightly and the roosts tilted at an angle of about 20 deg. Tilted roosts tend to prevent crooked keels from developing. For Broad-breasted Bronze poults

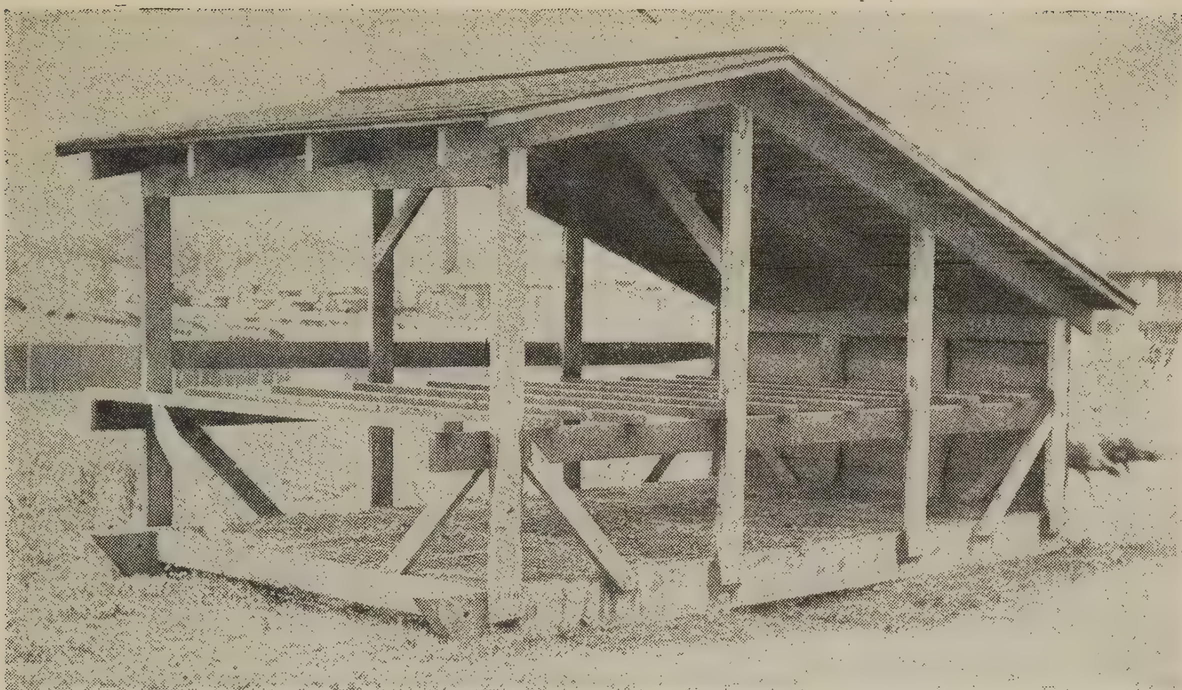


FIG. 82.—An 8′ × 15′ range shelter suitable for 150 poults from 8 to 14 weeks, at Pennsylvania State College. (*H. H. Kauffman, Pennsylvania Extension Service.*)

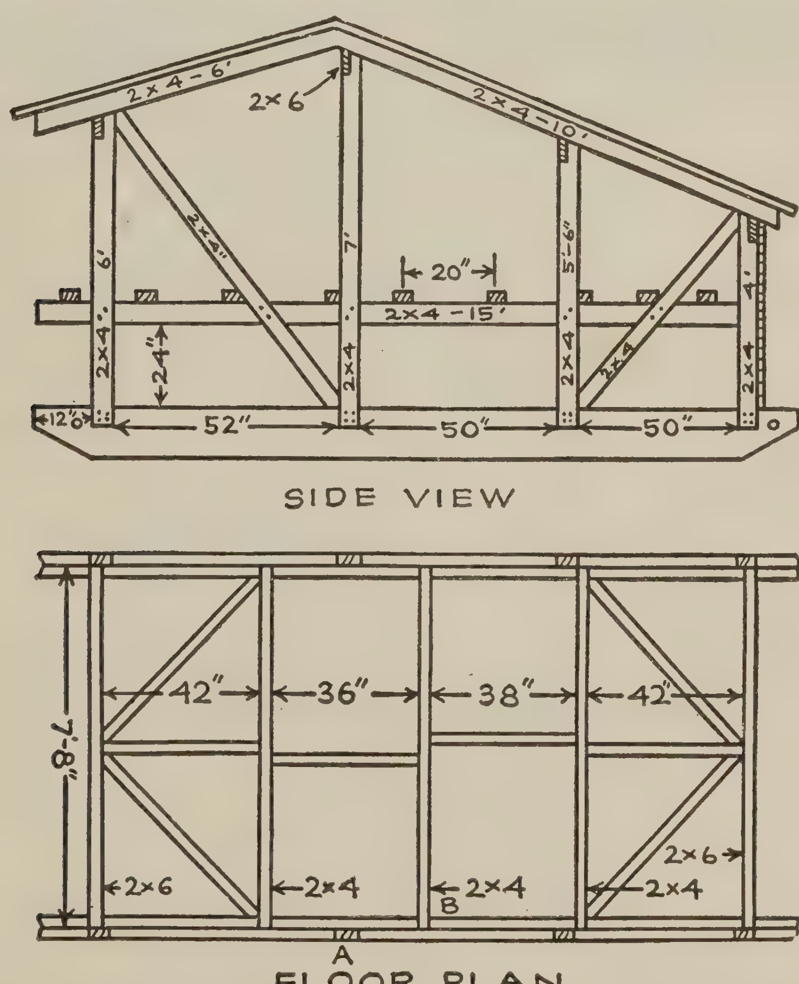


FIG. 83.—The side view and floor plan of 8′ × 15′ range shelter shown in Fig. 82. (*R. R. Murphy, Pennsylvania State College.*)

keep the roosts low, not over 2 ft. above the floor; in fact for other varieties low roosts help to keep down injuries to the legs, breast, and

Fig. 84.—A portable type of brooder house that can be converted into a range shelter for summer rearing, used extensively in Minnesota. (*Turkey World.*)

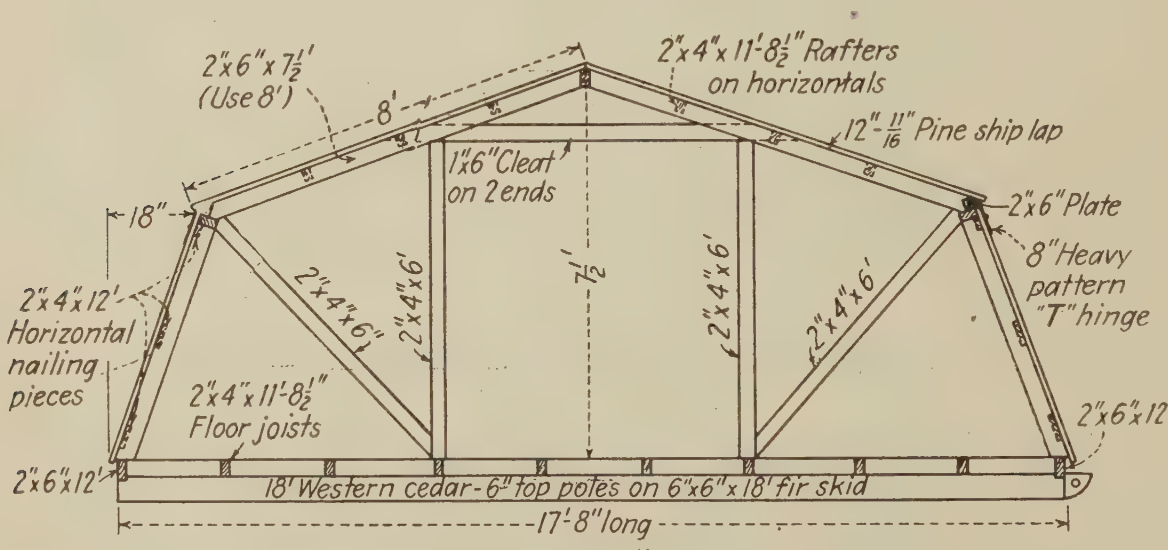


Fig. 85.—Construction details of combination brooder and range shelter shown in Fig. 84. (*Turkey World.*)

skin when the birds leave the roosts. Space the roosts at least 24 in. apart, center to center.

Permanent range shelters, such as shown in Figs. 86 and 87, are often used for large flocks and where a relatively large range, divided into yards, is available. Roofing, siding, and flooring details are the same as for portable range shelters.

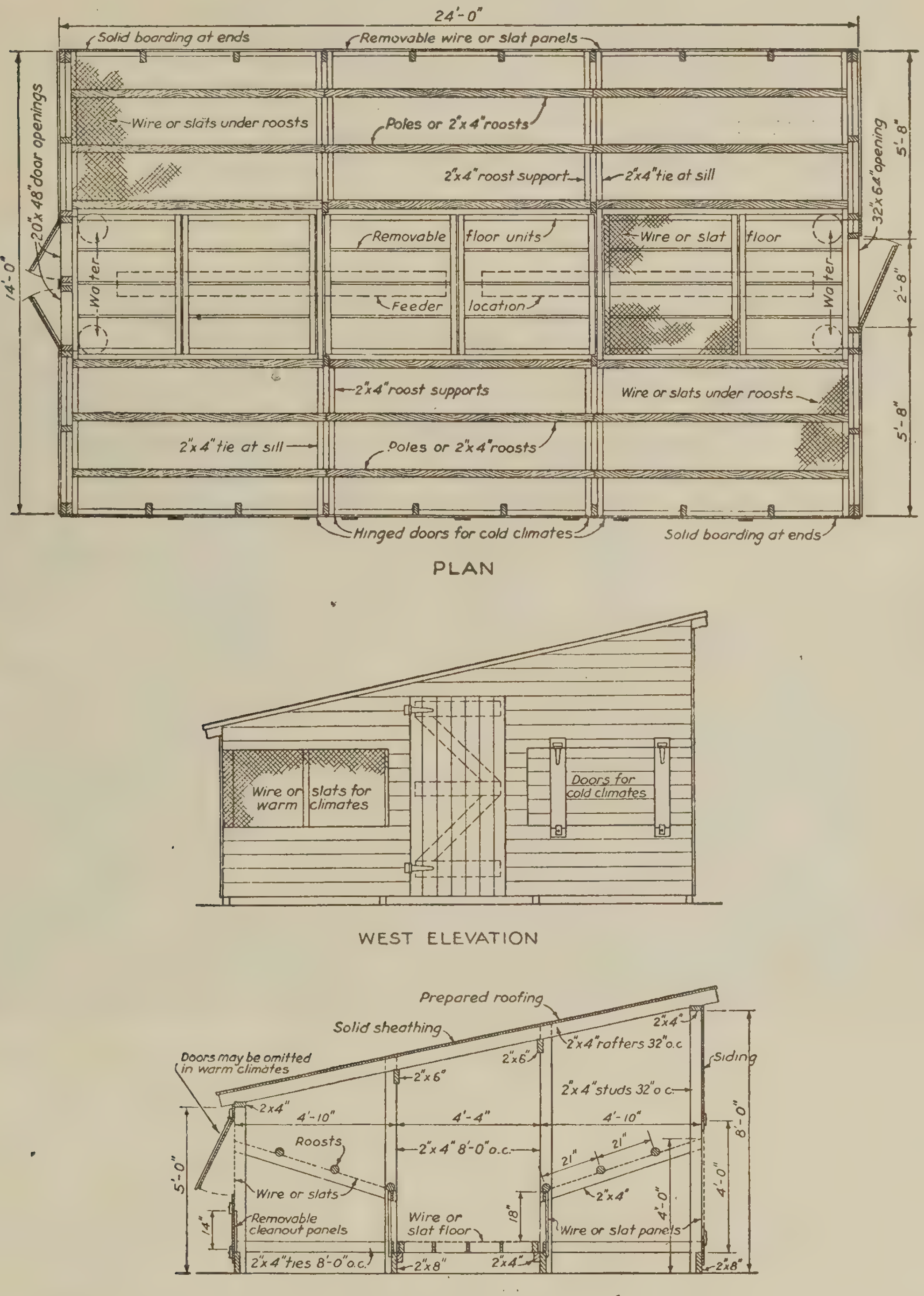


FIG. 86.—A permanent range shelter with center alleyway. Can be made any length desired and can be built with a gable roof. (*S. J. Marsden, U.S. Department of Agriculture.*)

Some turkey growers keep a brooder house conveniently located on the range and heated with a brooder stove so that after a heavy rain turkeys may go to it to get dried off.

Providing Range Feeders and Waterers. These should be built on skids so that they can be moved every week or oftener in order to prevent the ground around them from becoming contaminated. For the first 2 or 3 days after the poults have been moved to range, watch them carefully because they have to be taught to use the feeding and watering equipment in their new and strange surroundings.

Providing Shade. Abundant shade on the range is very important and should be provided by trees or by growing such crops as corn,

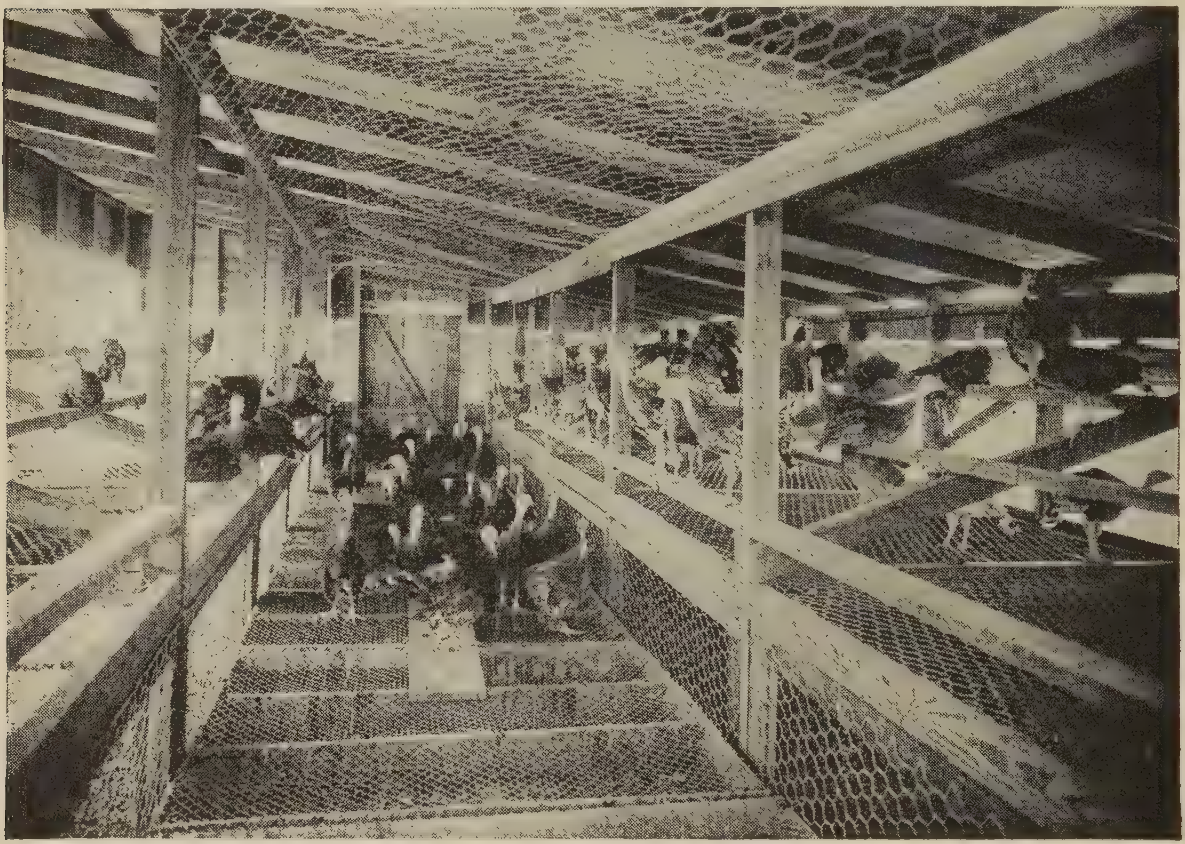
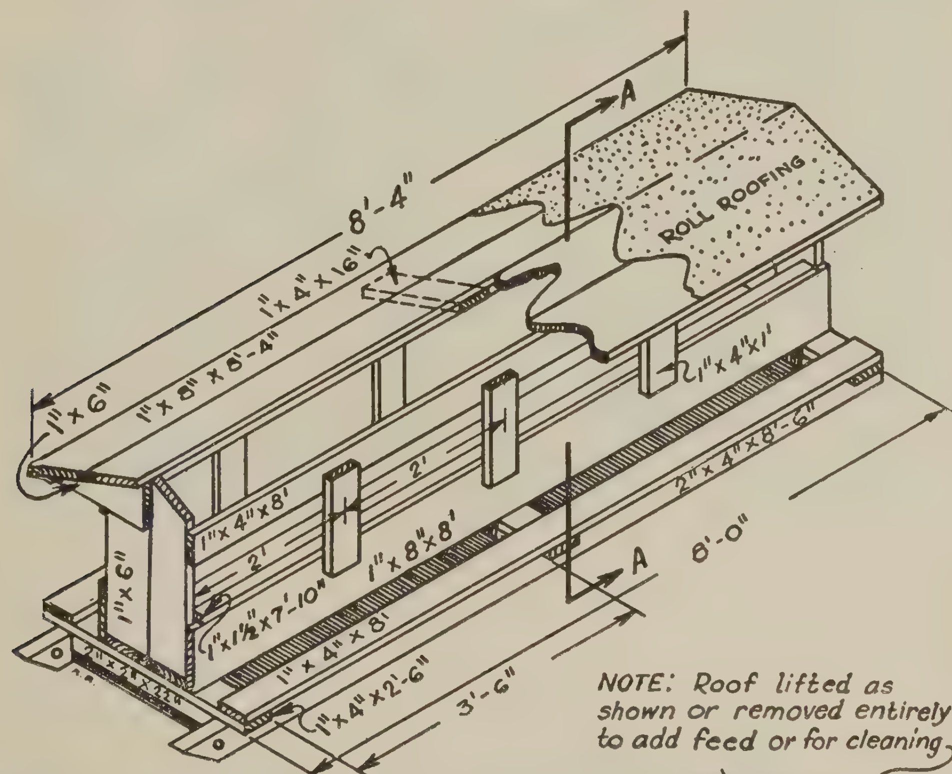


FIG. 87.—Interior view of permanent range shelter, plans for which are given in Fig. 86. (*S. J. Marsden and A. R. Lee, U.S. Department of Agriculture.*)

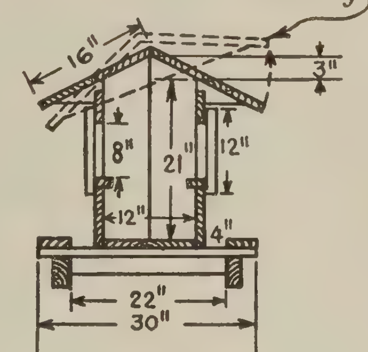
sunflowers, or castor beans in strips across the field between wider strips of bluegrass, Bermuda grass, clover, alfalfa, Sudan grass, or Lespedeza. Rape and soybeans make good forage crops for summer pasturing. Write the poultry department of your state college of agriculture for crops suitable for your section. The address of your state college is given in the Appendix.

Providing Fences and Gates. The smaller the area on which poults are ranged, the higher must be the fence to prevent them from flying over. Small and long, narrow yards need 6-ft. fences. Large yards need 5-ft. fences.

Durability is very important, especially in the case of portable fences that are put up and taken down perhaps several times in a season. Use heavy-weight, good-quality fencing, top and bottom wires 12½ gauge and center wires 15½ gauge, with stays not over



NO. PIECES	SIZE of MATERIALS	USE
2	2"x 4"x 8'-6"	Runners
3	2"x 2"x 1'-10"	Runner Braces
3	1"x 4"x 2'-6"	Joists
2	1"x 4"x 8'-0"	Foot boards
6	1"x 4"x 1'-0"	Side supports
2	1"x 4"x 8'-0"	Side braces
2	1"x 8"x 8'-0"	Side braces
2	1"x 4"x 1'-4"	Roof braces
4	1"x 8"x 8'-4"	Roof Sheathing
1	1"x 12"x 8'-0"	Flooring
2	1"x 1½"x 7'-10"	Feed protection
4	1"x 6"x 2'-0"	Ends
2	1"x 6"x 2'-0"	End roof braces
1	34"x 8'-6"	Roll roofing



CROSS-SECTION
A-A

FIG. 88.—A durable type of turkey range feeder. (*P. H. Gooding, South Carolina Agricultural College.*)

6 in. apart. Rustproof fence in sections having damp climates is essential. Use steel posts, galvanized for sections having humid climates, unless satisfactory wooden posts are very cheap. For 6-ft. fencing, use 9-ft. gate and corner posts and 8-ft. line posts. For 5-ft. fencing, use 8-ft. gate and corner posts and 7-ft. line posts. Space the line posts about 15 ft. apart unless the soil is loose or livestock is

in adjacent fields, in which case space the line posts about 10 ft. apart. Set all posts in cement for permanent fencing, except where yards are small and soil is heavy, in which case posts set in dirt may support the

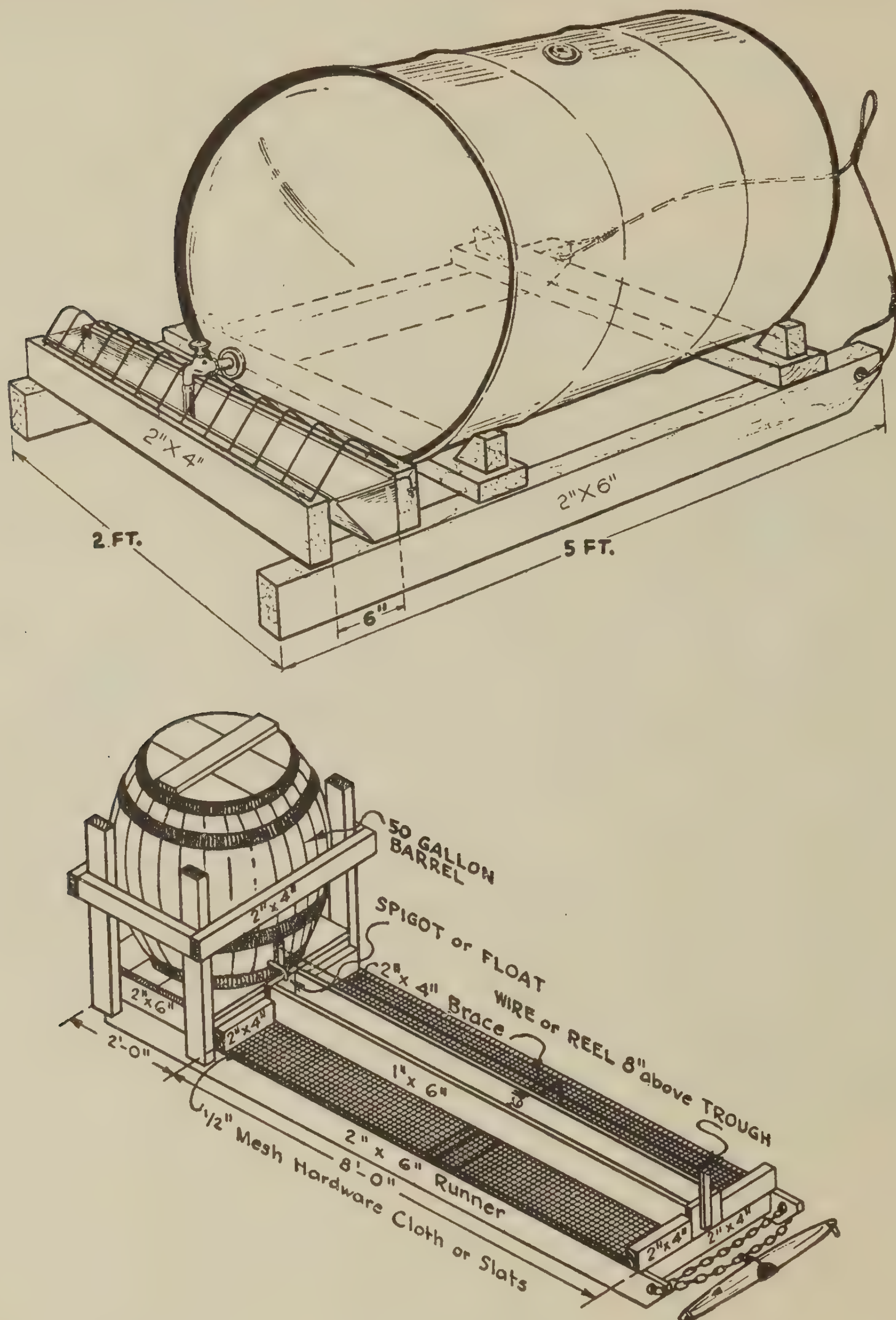


Fig. 89.—Top, a sanitary, readily movable range waterer for a small flock. (*Hess and Clark, Inc.*). Bottom, a very satisfactory portable range waterer for a large flock; note water trough on wire platform to keep turkeys out of droppings that tend to accumulate around watering utensils. (*P. H. Gooding, South Carolina Agricultural College.*) All watering equipment used on range should be moved frequently.

tightly stretched fence. In portable fences, which may be moved once or oftener during the rearing season, angle irons may be used for line posts. Fasten all fences along the ground around the outside

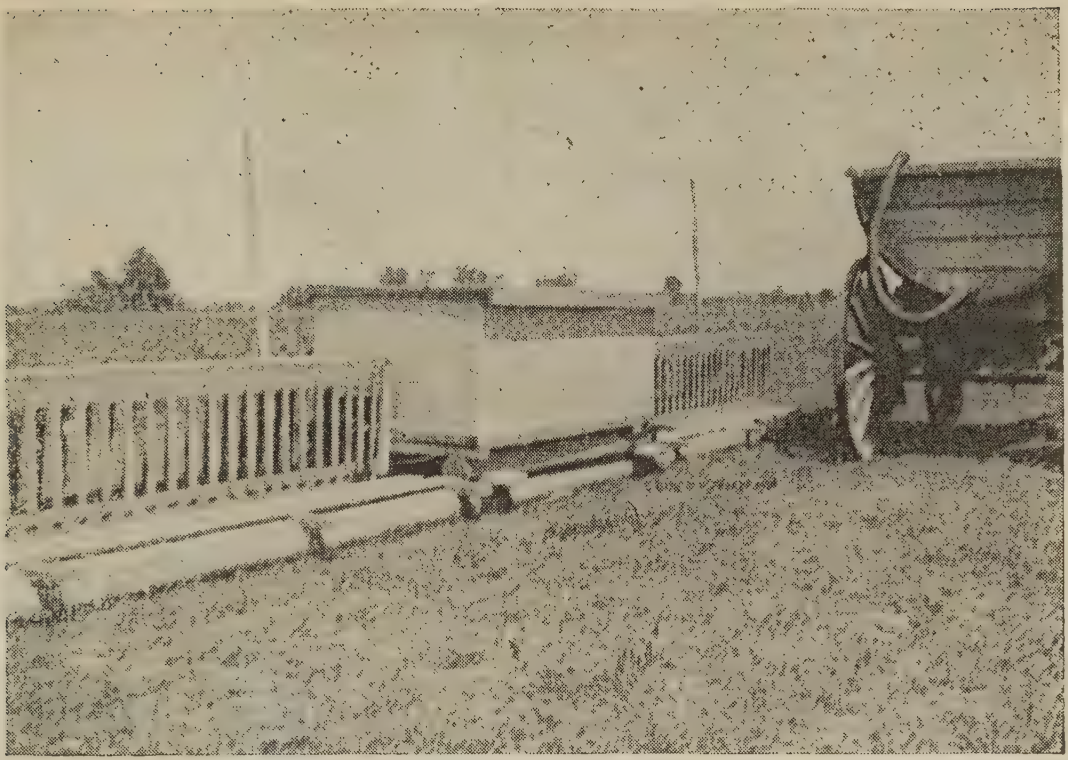


FIG. 90.—Covered watering troughs on skids connected to a water tank, which is kept supplied by a water wagon. (*N. L. Bennion, Oregon Agricultural College.*)

FIG. 91.—To prevent coyotes and other predatory animals from gaining access to the turkey field, R. Jandebeur in Nebraska lays down a 20-in. strip of woven wire just outside of the fence. The strip is staked down, as shown. (*Turkey World.*)

of the field so that dogs, coyotes, and other predatory animals are excluded, as indicated in Fig. 91.

Durability is important in gates. Use 12-ft. gates with strong steel frames, 12-ft. gates being preferable to 10-ft. gates for moving range shelters from field to field. Use strong 3-ft. gates for taking feed and water into yards to save opening the larger gates.

Fasten antiflies, about 3 ft. high, on top of all gates and extending about 20 ft. beyond each end of the gate. Place antiflies at the corners of range shelters whose tops are within 9 ft. of the ground. using junior-weight rectangular-mesh poultry wire stretched tightly

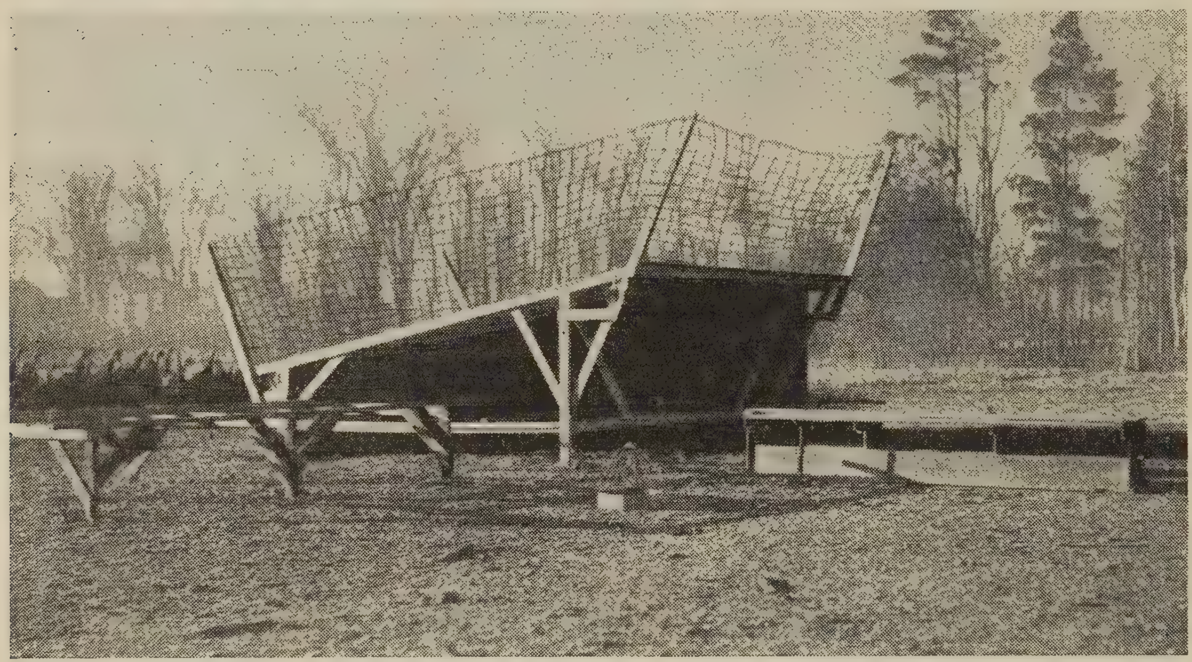


FIG. 92.—Range shelter with wire netting fastened to four pieces at corners to prevent poults from flying to top of shelter. (*W. E. Poley and W. O. Wilson, South Dakota Experiment Station.*)

between angle irons that are fastened securely and pointing away from the shelter (see Fig. 92).

Managing the Flock on Range. One of the most effective ways of teaching poults to take to the roosts in their new home is to move about a dozen of them to the range shelter the first night and teach them to roost. Move the rest of the flock the next day, and the first dozen will teach the rest where to roost.

Providing a clean range is absolutely necessary in order to secure best results in growth and to keep mortality at a minimum. Move range shelters and feeders and waterers at frequent intervals, or, if the flocks are in a permanent shelter, move the feeders and waterers at frequent intervals to avoid soil contamination.

Where a permanent bluegrass, Bermuda grass, alfalfa, or other suitable pasture can be maintained, a permanent range shelter could be located in the center of the field, which could be divided into four large yards, as indicated in Fig. 93. This would give the poults access to each yard every 2 or 4 weeks. A better arrangement would be to use portable range shelters in a field divided into four equal areas with temporary fences, the shelters and feeders and waterers being moved from one field to another every week, as indicated in Fig. 94.

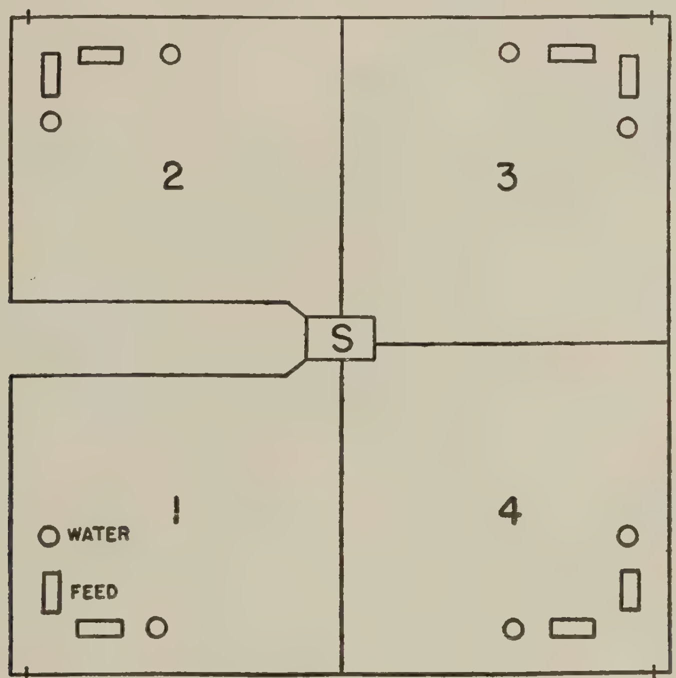


FIG. 93.—A four-field arrangement for rearing turkeys with a permanent shelter. The feeders and waterers are tended to through a gate at the corner of each field and are moved from one field to another every week. (*M. A. Jull and W. Rice, University of Maryland*)

Turkey growers in some of the western states sometimes herd their turkeys on the wide-open ranges by providing the attendant with a covered wagon, a trailer, or a tent and by arranging roosts on wagons so that the turkeys can be moved about on the range as the growing season advances.

The amount of land required for a given-sized flock depends upon the type of soil, the amount and kind of vegetation that can be maintained, and whether or not a yard rotation system is practiced. The range for turkeys should have good surface drainage because stagnant puddles of water are conducive to the spread of disease.

With respect to the amount of range needed for poults, keep these three things in mind: (1) poults differing much in age should be reared on separate ranges, especially in the fore part of the season; (2) the longer the poults are kept on the same area or in the same field, the larger must be the area or field; (3) moving range shelters and feeders and waterers frequently is absolutely necessary to combat blackhead.

On sandy loams supporting good vegetation, when flocks are moved weekly and feeders and waterers are moved daily, provide at least 1 acre for 200 poults, 4 acres for 1,000, 7 acres for 2,000, and 12 acres for 4,000. The fields must be well drained and strictest sanitation practiced. With equally good vegetation but when flocks are moved every 2 or 4 weeks and feeders and waterers are moved

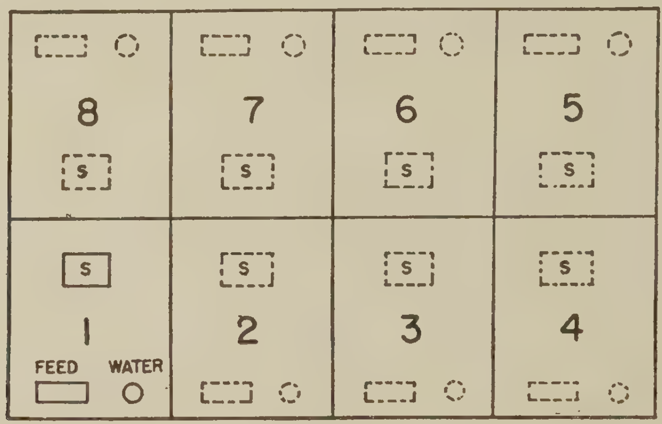


Fig. 94.—An eight-field arrangement, with temporary fences separating the fields, for rearing turkeys with a portable summer shelter, *S*. The feeders and water containers are located next to the outside fence, so that feeding and watering can be done through a temporary gate. The poults, shelter, feeders, and waterers are moved from one field to another at the end of each week. (*M. A. Jull and W. Rice, University of Maryland.*)

weekly, provide at least 1 acre for 100 poults, 8 acres for 1,000, 14 acres for 2,000, and 24 acres for 4,000. On heavy clay soils that are poorly drained, provide more range than indicated above. Overcrowding on the range tends to promote feather picking and cannibalism.

7. Keeping Rearing Losses at a Minimum

Losses from every possible cause must be kept at a minimum because half-grown poults mean quite an investment in cost of poults and feed and labor in brooding and rearing. The loss of poults reared to marketing time is very costly.

Clipping Wings to Prevent Flying. To prevent turkeys from flying fences and becoming lost or devoured by dogs, foxes, or coyotes, clip about one-half of the primaries of one wing of each poult, using rough-edged shears. If you are keeping any of the larger sized varieties, clip all poults at about 11 weeks of age and all female poults again at about 18 weeks of age. If you are keeping the small-sized varieties, clip all poults at about 9, 15, and 20 weeks of age. However, it is important not to clip the primaries of any tom that is to be used for breeding purposes because to do so might interfere with mating.

Performing Tenotomy to Prevent Flying. An effective method of preventing flying over fences is to sever the main wing tendon,

Fig. 95.—Tragic losses, due to blizzards, sometimes occur in flocks almost ready for market. (*Turkey World.*)

which passes over the outer edge of the last joint of the wing. Flex the joint and with an electric wood-burning needle burn through the skin and the tendon. Perform the operation on one wing only. Toms that may later be selected for breeding purposes should not be subjected to this treatment.

Preventing Stampeding. Poults on range are easily frightened, especially on bright moonlight nights. They are very liable to fly from the roosts and shelters and may pile up in a corner of the field or in the corner of a permanent shelter. Broken wings and legs and smothering often result. Some of the best precautions to prevent stampeding include (1) the use of night lights or flares, such as are used to guard parked trucks on the roadside at night, to keep predatory animals away; (2) the provision of a tent or other sleeping quarters for an attendant.

Using Storm Fences to Avoid Loss from Blizzards. In some of the West North Central states turkey raisers have sometimes suffered heavy losses from blizzards in the late fall and early winter (see Fig. 95). Losses have amounted to several thousand birds for a single turkey raiser. For turkey growers whose flocks do not have the protection provided by groves or other windbreaks, apparently the best precaution against loss from blizzards is to pull the range shelters together as shown in Fig. 96 and enclose the backs and sides

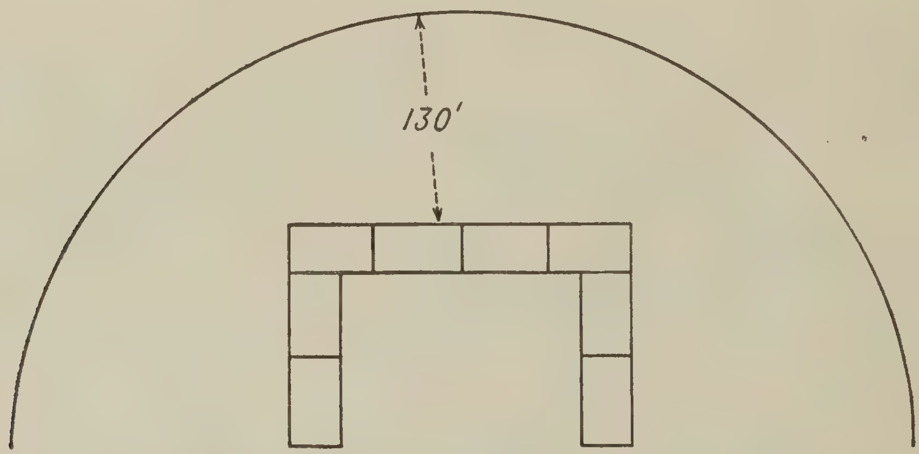


FIG. 96.—In the storm belt, range houses should be pulled together before November 1 and prepared for winter storms. The arrangement shown here is popular for those who have little or no natural protection afforded by groves or other windbreaks. The half circle represents snow fencing. The arrangement within represents shelters, which are closed on the backs and ends, leaving only the front opening into the central court. Although having shelters with all four sides enclosed is best, the arrangement shown here assures good protection. The opening of the U should be toward the southeast, which places the snow fencing to the northwest of the shelters, thereby breaking the force of prevailing winds and causing the snow to drop between the snow fence and the shelters. (*Turkey World.*)

of each shelter. Place a high semicircular snow fence around the backs and sides of the shelters, the snow fence being about 130 ft. away from the north side of the back row of shelters. The snow fences help to break the force of the wind and cause the snow to pile up at the fence instead of over the houses, where it would otherwise smother many of the birds.

Turkey growers in sections where flocks are subject to loss from storms could avoid some of the loss by starting their turkeys early enough so that they would be in prime market condition for the Thanksgiving market or earlier.

Using Other Protection Measures. It is possible for turkey growers to take out insurance against losses from storms. This has proved to be a very important factor in stabilizing the turkey industry in the sections of the country involved.

Protection against Wild Birds. Owls, crows, and hawks sometimes attack young poults. Range shelters with roosts provide some protection at night and a long pole with a bright cloth or tin and a lighted lantern provide some protection in the daytime and at night (see Fig. 97).

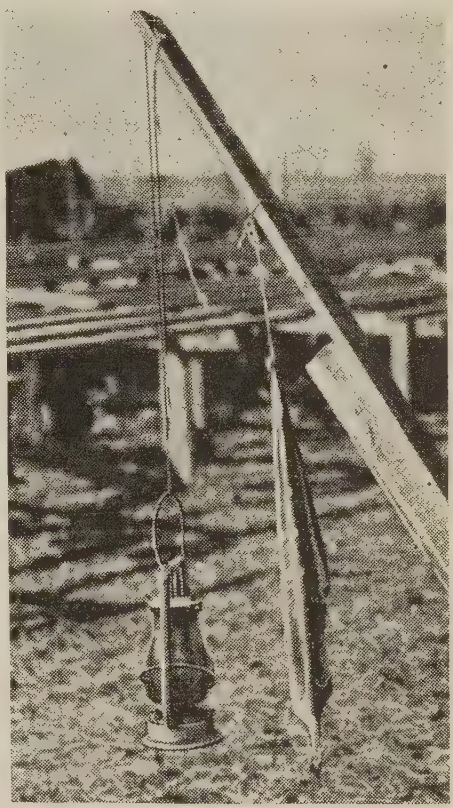


FIG. 97.—A lighted lantern at night and a bright-colored cloth in the daytime help to keep predators from the flock. (*L. E. Cline, Nevada Extension Service.*)

Protection from Thieves. It is a sad travesty on human nature that some people will stoop so low as to steal a full-grown crop of turkeys produced by the honest labor of another man. A tent or other sleeping quarters for a night watchman supplied with a gun, watch dogs, electric lights, and flares all help to discourage thieving. It would be desirable if punishment for thieves caught was made more severe than is usually the case.

Tattooing for Identification. Tattooing, by stamping indelible letters on the underside web of the wing, is a positive measure of identifying the owner of birds in case of theft. Some states have a state-wide system involving a code number for each flock owner, and through the cooperation of police it is possible to establish ownership of the birds. Tattoo the poults at about 8 weeks of age and be sure to punch through the web of the wing and use enough of the proper kind of tattoo ink.

SUMMARY

1. When brooding poults with a hen, keep her confined in the coop for about 2 weeks. Keep the poults confined within an enclosure attached to the coop for about the same period of time, but move the coop every 2 or 3 days and watch the poults carefully in rainy weather.

2. When brooding poults artificially, start with a thoroughly cleaned and well-disinfected brooder house.

3. Start the brooder 2 or 3 days before placing poults under it and maintain a temperature of 95°F. at the edge of the canopy or hover for the first few days. Depending upon the season, lower the temperature about 5° weekly until about the sixth to tenth week, when no more heat is needed.

4. A 10′ × 12′ colony brooder house will accommodate about 150 poults up to 8 weeks, about 1 sq. ft. of floor space per poult being necessary. Overcrowding retards growth and increases mortality. A wire-floored sun porch should be attached to the house.

5. Provide roosts when poults are about 10 days old.

6. Place feeders and water containers on wire platforms.

7. Provide ample feeding space and plenty of waterers.

8. A low-watt all-night light tends to prveent turkeys from piling up in the brooder house at night.

9. Keeping poults confined to sun porches with wire or slatted floors combats disease.

10. If poults are to be reared on range, transfer them from the brooder house to the range when they are about 8 weeks old.

11. Providing a clean range is absolutely necessary for best results in growth and for keeping mortality at a minimum.

12. If portable shelters are used, move them frequently, as well as feeders and waterers.

13. If permanent shelters are used, a yard-rotation system should be adopted for the poults and the feeders and waterers should be moved from yard to yard at frequent intervals.

14. Grow summer crops if permanent vegetation is not available.

15. In sections of the country noted for blizzards, provide ample protection against loss.

5. Feeding Breeders and Turkey Poults

THE principal object in raising turkeys is to transform cereal grains and other feedstuffs into turkey meat for human consumption. This should be done as economically as possible, which means that each pound of gain in weight should be secured on the fewest possible pounds of feed consumed by the poults. The cost of feed usually represents over one-half of the cost of rearing the poults to marketing time. It is obvious, therefore, that in order to produce turkey meat as economically as possible, feedstuffs that are utilized efficiently must be fed. This can only be accomplished when the diets fed contain feedstuffs that supply the right kind of nutrients in proper proportions.

At the same time, everyone realizes that the kind of diets fed to breeding stock is important because of their effect on the number of eggs produced and on their hatchability. Well-balanced diets for the breeding stock are important, therefore, in order to secure good egg production and good hatchability, otherwise fewer poults are secured, which results in a higher cost per poult. In this chapter the activities discussed in feeding breeders and poults are

1. Preparing Properly Balanced Diets
   - Supplying Feed High in Nutritional Value
2. Feeding the Breeding Stock
   - Preparing Diets for Breeding Stock
3. Feeding the Poults
   - Determining Relative Value of Different Feedstuffs
   - Preparing Diets for Poults
   - Adopting and Following a Good Feeding Program
4. Preventing Vices and Abnormalities
5. Determining Pounds of Feed per Pound Gain in Weight
6. Making Use of Turkey Manure

1. Preparing Properly Balanced Diets

For most efficient egg production by breeding stock and meat production by poults, the diets fed must be properly balanced with respect to the different nutrients they contain. These nutrients consist of water, carbohydrates, fats, proteins, minerals, and vitamins. Water is of very great importance in maintaining health and in promoting growth, fleshing, and egg production. As a matter of fact, turkeys can go longer without feed than without water. The carbohydrates and fats are supplied principally by the cereal grains. The proteins are supplied by the cereal grains, forage crops, and by such animal products as milk, fish meal, and meat scrap. Minerals are

Fig. 98.—Farm boys are not only a great help to their fathers in the turkey enterprise but many have F.F.A. or 4-H turkey projects of their own. In carrying on these projects they learn a great deal about turkey feeding principles and practice. (*Turkey World.*)

supplied by cereal grains, forage crops, and by other products such as bone meal, oystershell, and ground limestone. Vitamins are supplied by cereal grains, forage crops, cod-liver oil, fish feeding oil, and other products processed to increase their vitamin potency.

Cereal grains constitute the bulk of the diets fed to breeding stock and poults. For best results, however, cereal grains must be supplemented with other feedstuffs that are relatively rich in protein, minerals, and vitamins. The more important functions served by all the nutrients are discussed in detail in "Successful Poultry Management" and, therefore, are not reviewed here.

Table 20 contains a brief statement of the functions of the nutrients, except vitamins, and symptoms exhibited by turkeys when diets are deficient in these nutrients. Calcium, phosphorus, and manganese are the three most important minerals that are deficient in diets ordinarily fed to turkeys.

Table 20. Nutrients, except Vitamins, Required by Turkeys

Nutrient	Important functions	Deficiency symptoms
Water	Softens feed, aids in the processes of digestion and absorption of other feeds. Helps to regulate body temperature. Assists in the elimination of waste products	Retarded growth. Decreased egg production. Loss of body weight and death, if water is withheld for a considerable period
Carbohydrates	Source of energy, for maintaining body temperature and for all bodily activities and for growth and egg production	Retarded growth. Decreased egg production. Loss of body weight
Fats	Source of energy, to a limited extent only. Sometimes deposited in body	There are practically no fat-deficiency symptoms
Protein	Growth. Repair of body tissue. Egg production	Retarded growth. Decreased egg production. Loss of body weight
Calcium	Formation of bone and eggshell. Heart rhythm. Muscle tone. Blood clotting	Retarded growth. Soft bones. Decreased egg production and hatchability. Thin shells
Phosphorus	Bone development. Egg production. Utilization of carbohydrates	Retarded growth. Soft bones. Decreased egg production
Manganese	Utilization of phosphorus	Slipped tendon or perosis. Decreased hatchability and abnormal embryos

Other minerals required by poults include iron, copper, magnesium, potassium, sodium, chlorine, iodine, and sulphur. Practically all these minerals are present in sufficient quantities in normal diets, except sometimes sodium and chlorine, which are supplied by adding salt to the diet.

Table 21 contains a brief statement of the symptoms resulting from vitamin deficiencies exhibited by turkeys and the principal sources of vitamins to balance the diet properly to maintain health, good egg production, high hatchability, and rapid growth.

During recent years there have been rapid advances in the science of feeding turkeys, but there have also been rapid changes in management practices, which have given rise to an increased demand for more and more new knowledge of the nutritive requirements of breeding stock and poults. Practically all turkey feeding programs include mash, scratch grain, and minerals. Protein, mineral, and vitamin

TABLE 21. VITAMINS REQUIRED BY TURKEYS
(T. H. Jukes, California Experiment Station, 1944)

Vitamin	Symptoms of deficiency in turkeys	Sources of supply
A	Slow growth, unthrifty appearance, listlessness, watery eyes, nasal discharge, white matter in eyes and sinuses, high mortality	Alfalfa leaf meal of good quality, fresh greens, yellow corn, and biologically tested fish oils
Thiamine (B_1)	Loss of appetite, failure to grow, nervous spasms with head drawn back. Symptoms are not seen under ordinary conditions	Scratch grains, ground grains, bran, and middlings
Riboflavin (G)	In poults, slow growth and dermatitis, encrustations at corners of mouth, stuck eyelids, ragged feathers, and diarrhea. The deficiency in adult turkeys produces low hatchability	Riboflavin is best supplied by fresh and dried greens, alfalfa meal, dried milk, and dried whey
Pantothenic acid	Slow growth and high mortality in poults	Ordinarily a ration containing 10% bran, 8% alfalfa meal, and 5% dried milk or dried whey will supply enough pantothenic acid
Biotin (H)	Slow growth, dermatitis, and perosis in poults	Soybean meal, scratch grains, ground grains, alfalfa, grain by-products, and molasses
Pyridoxine (B_6)	In poults, loss of appetite, slow growth, apathy, convulsions, and death	Grains, grain by-products, soybean meal, molasses
D	*Young birds:* Rickets, marked by slow growth, soft beak and bones, leg weakness, ruffled feathers. Later the poults cannot stand and death results *Laying hens:* Low egg production, low hatchability, and an increase in soft-shelled eggs	Direct sunlight is nature's source of vitamin D. If birds are not receiving much direct sunlight, vitamin D must be added to the mash as tested fish oil or synthetic vitamin D
E	Symptoms of deficiency in turkeys unknown	Fresh greens, alfalfa meal, grains, and grain by-products. It has not been shown that a deficiency of this vitamin exists in rations ordinarily fed to turkeys
K	A bird deficient in vitamin K is apparently normal, but the blood will not clot	Fresh and dried greens are very rich in vitamin K. No danger of deficiency exists
Choline	Slow growth and perosis in young poults	Soybean meal and fish meal are good sources. Most natural feeds supply small amounts. Barley appears to be a better source than the other common grains
Gizzard factor	Erosions in the gizzard lining	Alfalfa meal, wheat bran, fresh greens, and rice bran supply the factor
Other vitamins	Other vitamins are known to be needed	These are present in commonly used feeding stuffs such as grains and green leaves

supplements that must be provided in order to make up for the deficiency of these nutrients in cereal grains are for the most part added to the mash portion of the diet. This means that the composition of mashes fed to turkeys of different ages must be given very careful consideration. This is true in the case of home-mixed and commercial mashes. Because of the great variations in the quality of feedstuffs that frequently prevail, commercial feed mixers should be in a better position than the poultrymen to prepare mashes that are properly balanced with respect to the different nutrients required by turkeys.

A balanced diet is one that contains the various nutrients in such proportions that the diet is utilized efficiently in promoting rapid growth or good egg production and high hatchability. The breed-

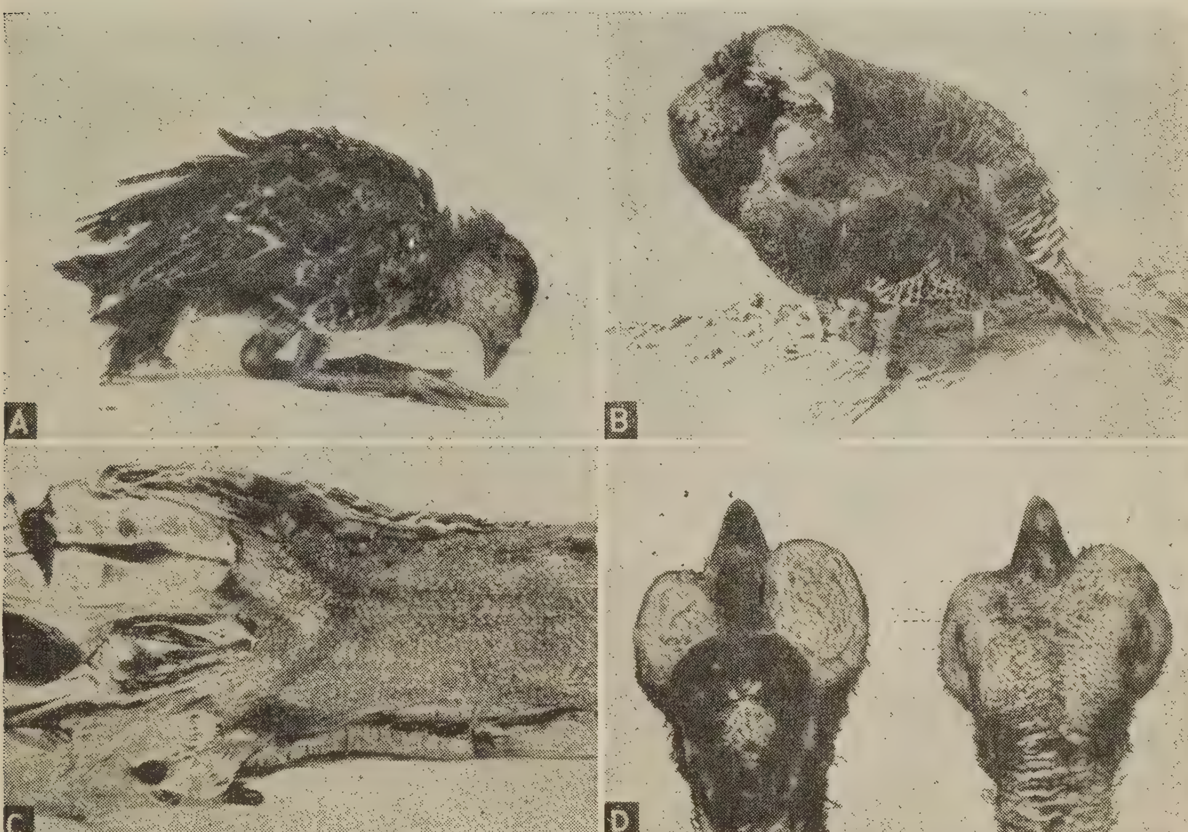


Fig. 99.—Symptoms of vitamin A deficiency in turkey. (*A*) Poult. (*B*) Hen suffering from acute vitamin A deficiency. (*C*) Pustular lesions in esophagus of turkey hen suffering from vitamin A deficiency. (*D*) Extreme case of sinusitis in a turkey hen suffering from marked vitamin A deficiency. (*W. R. Hinshaw*, *California Experiment Station.*)

ing stock needs relatively less protein in the diet than poults during the first few weeks but about the same amount as poults as they approach market age. The calcium and vitamin A requirements of breeders are relatively greater than those of poults, but the vitamin D and riboflavin requirements of breeders are relatively less than those of poults during the first few weeks.

For breeders and for growing poults of different ages it is quite important to have the nutrients in the proportions indicated by the newer knowledge of turkey nutrition. Protein is relatively the most expensive part of the diet, so that feeding the proper level is very important to avoid wastage and still secure maximum growth or egg production. The ratio of calcium to phosphorus is important in the case both of breeders and poults. The fact must always be kept in mind that if there are serious deficiencies of some of the vitamins certain nutritional-deficiency diseases are bound to result, especially in the case of growing poults.

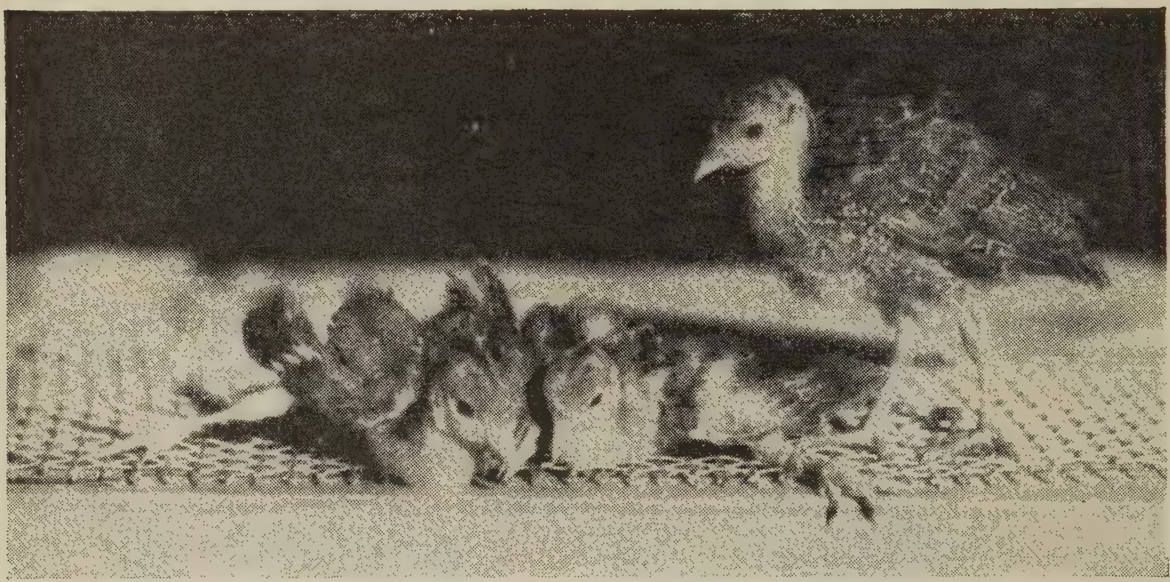


FIG. 100.—The two poults at left are suffering from rickets, the result of being raised in confinement in absence of sunlight and fed a diet containing no vitamin D. Poult at right from same hatch was also raised in absence of sunlight but received fish oil in diet as a source of vitamin D. (*V. S. Asmundson and T. H. Jukes, University of California.*)

In Table 22 are given the desirable amounts of nutrients that should be contained in diets for breeding stock and poults of different ages. The nutrients mentioned in Table 22 include those, except fiber and phosphorus, which are usually contained in insufficient quantities in the cereal grains and therefore have to be added as supplements to provide properly balanced diets. The desirable fiber content of turkey diets is mentioned because it is more important in diets for turkeys than in diets for chickens. The desirable phosphorus content is mentioned because of the importance of maintaining a certain ratio between the calcium content and the phosphorus content of the diet.

Poults are usually fed mash exclusively during about the first 8 weeks, otherwise practically all turkey diets consist of mash and a so-called "scratch grain," which may consist of corn or a mixture of two or more cereals, including corn, wheat, oats, barley, and proso millet. Mashes and scratch grains are usually fed ad libitum, which simply means that they are accessible to the turkeys at all times. When the mash- and scratch-grain combination is fed, turkeys usually adjust the consumption of each of these two kinds of feed to supply them with the proportion of protein given in Table 22. The consumption of the other nutrients listed in Table 22 is controlled by the amount provided in the diet, except that birds given access to sunlight and birds on succulent pasture obtain vitamin D from sunlight and protein, some minerals, riboflavin, and perhaps other vitamins in addition to those supplied in the diet.

TABLE 22. DESIRABLE AMOUNTS OF VARIOUS NUTRIENTS FOR BREEDING STOCK AND POULTS OF DIFFERENT AGES

Nutrient	Breeding stock	Poults to about 8 weeks	Poults after about 8 weeks
Protein, percentage of diet	16.5	25.0	13.0–24.0*
Crude fiber, percentage of diet	6.5	6.5	6.5
Calcium, percentage of diet	2.4	1.5	1.5
Phosphorus, percentage of diet	0.75	1.0†	1.0†
Salt, percentage of diet	1.0	1.0	1.0
Manganese, parts per million of diet	50	50	50
Vitamin A, International units per pound of diet	4600	2500	2500
Thiamine, International units per pound of diet	250	250	225
Riboflavin, micrograms per pound of diet	1400	1800	1400
Vitamin D, A.O.A.C. units per pound of diet	450–675‡	450–1350‡	225–450‡

* As the poults approach market age, the protein requirements decrease. Poults balance their diets accordingly by consuming relatively more scratch grain in proportion to mash as they increase in age.

† 0.2 per cent of the total feed should be non-phytin phosphorus.

‡ Turkeys of all ages kept in strict confinement require more vitamin D supplements in the diet than turkeys having access to sunlight. For poults up to about 8 weeks approximately 450 units of vitamin D from irradiated animal sterols are required, whereas about 900 units of vitamin D from Reference Cod Liver Oil No. 2 or sardine oil are required per pound of feed.

Supplying Feed High in Nutritional Value. You can feed a mash containing the approximate proportions of nutrients suggested in Table 22 and still not secure maximum growth in poults or maximum egg production and hatchability from hens. Two mashes may be of approximately the same chemical composition but may be quite different in feeding value.

Mashes sometimes differ markedly in the nutritional value of the protein supplements even though the percentage of protein is the same in each mash. Meat scrap made from glandular tissue is superior to many other kinds of meat scrap. The temperatures employed in processing meat scrap may affect the nutritional value of its protein content. Fish meal processed at a low temperature usually has a higher nutritional value than fish meal processed at a very high temperature. Either steam-dried or vacuum-dried fish meals are satisfactory but flame-dried fish meals are not so good.

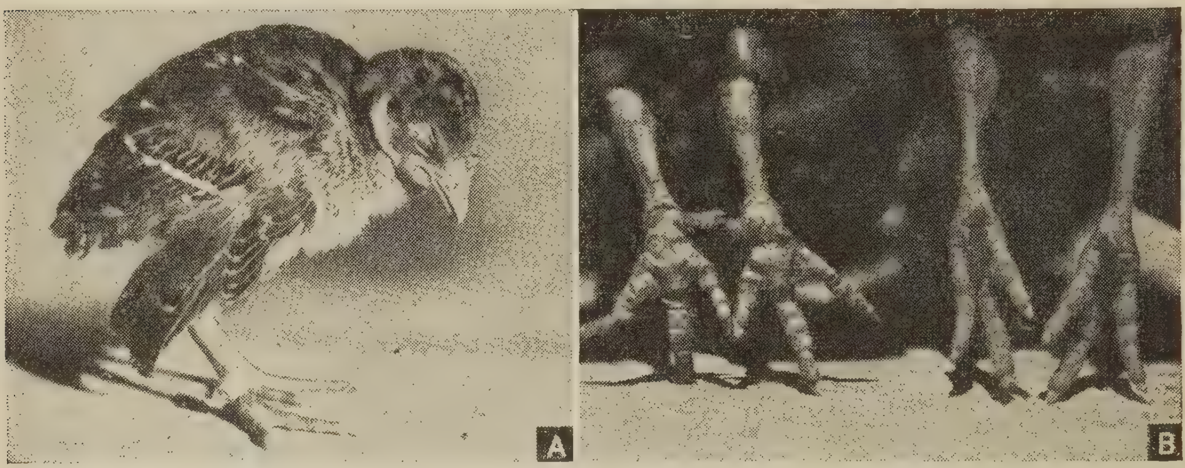


FIG. 101.—Symptoms of riboflavin deficiency. (*A*) Dermatitis in a turkey poult due to riboflavin deficiency in the diet. Note encrusted mouth and eyelids stuck together. (*B*) Note the swelling and peeling of the left pair of shanks. The pair of shanks on the right is of a poult fed the same diet but to which riboflavin was added. (*T. H. Jukes, University of California.*)

The nutritional value of the protein in soybean oil meal depends to some extent on whether the expeller, solvent, or hydraulic method of processing is employed and the temperature used in each method, meals prepared by the first two methods being superior. Meals

FIG. 102.—Symptoms of perosis in poults 8 weeks of age. (*A*) Slight hock enlargement. (*B*) Moderate hock enlargement. (*C*) Severe case, showing slipped tendon complicated by twisted left shank. (*R. J. Evans, E. I. Robertson, M. Rhian, and L. A. Wilhelm, Washington Experiment Station.*)

heated at a temperature of approximately 219°F. have been found to be superior to meals heated at lower and higher temperatures. Since the nutritional value of protein supplements is often affected so much by the method of processing, make sure of purchasing the best kind of supplements if you feed a home-mixed mash.

Mineral supplements are used to supply adequate levels of calcium, phosphorus, sodium chloride, and manganese. Calcium is supplied in the form of ground limestone, oystershell, bone meal, or defluorinated calcium phosphate. Phosphorus is supplied in the form of bone meal and defluorinated calcium phosphate. Sodium chloride is supplied in the form of table salt. Manganese is supplied in the form of manganous sulphate.

The source of vitamins has been indicated in Table 21, the three which ordinarily need to be supplied as supplements being A, D, and

FIG. 103.—Symptoms of nicotinic acid deficiency in poult. (*A*) Note poor feathering, poor growth, and perosis. This poult weighed 190 grams at 4 weeks as compared with average weight of 369 grams for other poults on same diet except that nicotinic acid was not deficient. (*B*) Rear view of same bird, showing perosis. (*G. M. Briggs, University of Maryland.*)

riboflavin. With respect to A and D, keep in mind that they tend to lose their potency the longer they have been mixed with the mash and the longer the mash has been stored before being used. Therefore, use freshly mixed mashes. With respect to vitamin, A the longer alfalfa leaf meal or alfalfa meal has been stored, especially in warm weather, the greater the decrease in the carotene content, carotene being a precursor of vitamin A. Here again is an important reason why you should use freshly prepared feedstuffs in preparing turkey mash. If you purchase alfalfa leaf meal or alfalfa meal to make up a home-mixed mash, be guided by the carotene content of the meal at the time of purchase.

Fresh feed is always more palatable than stale feed and, in addition, has a higher nutritional value. Another factor concerning the condition of the feed that affects its nutritional value is degree of bulkiness of the mash. Finely ground grains tend to stick to the beaks of poults and sometimes cause trouble.

2. Feeding the Breeding Stock

We are now ready to consider the kinds and relative amounts of different feedstuffs that can be used to prepare satisfactory diets for

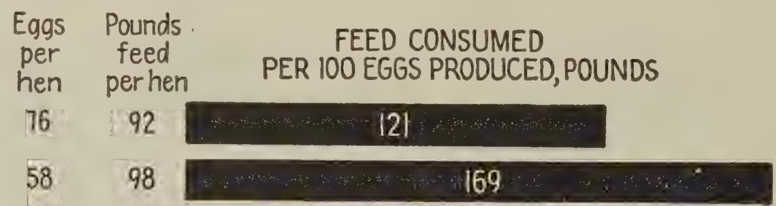


Fig. 104.—An average difference of 18 eggs per hen from Dec. 1 to May 31 in these two flocks of turkey breeders meant that the better laying flock produced each 100 eggs on an average of 48 fewer lb. of feed. (*Graph made from data of D. Whitson, S. J. Marsden, and H. W. Titus, U.S. Department of Agriculture.*)

egg production and hatchability. Always keep in mind that turkey breeding stock is kept exclusively for the production of hatching eggs. You not only want good egg production but you want to secure the highest possible hatchability so that the newly hatched poults are produced as economically as possible.

Many more pounds of feed are consumed per 100 eggs produced by a flock that lays poorly compared with a flock that lays well.

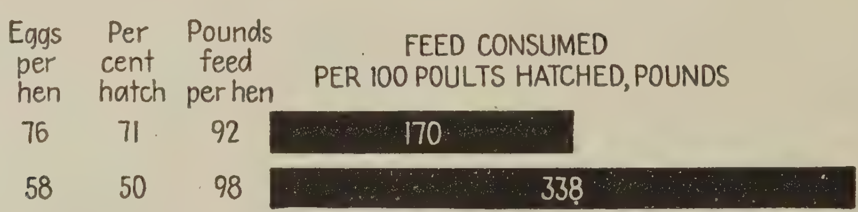


Fig. 105.—A flock of turkey breeders that laid an average of 76 eggs per hen between Dec. 1 and May 31 and 71 per cent of their eggs hatched produced each 100 poults on 168 fewer lb. of feed than another flock that laid an average of 58 eggs, only 50 per cent of which hatched. (*Graph made from data of D. Whitson, S. J. Marsden, and H. W. Titus, U.S. Department of Agriculture.*)

The data in Fig. 104 show clearly why it is so important to secure good egg production, especially when feed prices are high.

If the eggs of a poor-laying flock hatch poorly, the number of pounds of feed consumed per 100 poults hatched is much greater than is the case with a good-laying flock whose eggs hatch much better, as shown in Fig. 105.

Study Figs. 104 and 105 carefully and you will realize why it is so important to feed breeding stock well-balanced diets to secure good egg production and high hatchability.

Figure 106 shows the very low egg production secured from a flock of Broad-breasted Bronze breeders fed a diet seriously deficient in vitamin D and over three times as good production from another

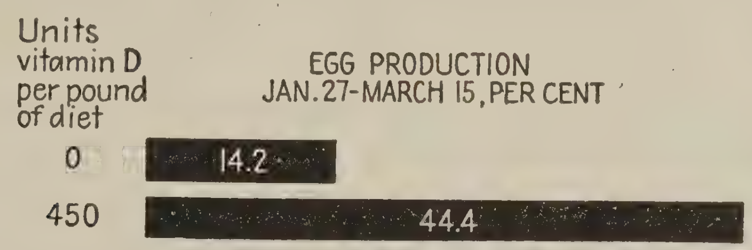


FIG. 106.—Supplementing a diet deficient in vitamin D increased egg production from 14.2 to 44.4 per cent. (*Graph made from data of L. A. Wilhelm, E. I. Robertson, and M. Rhian, Washington Experiment Station.*)

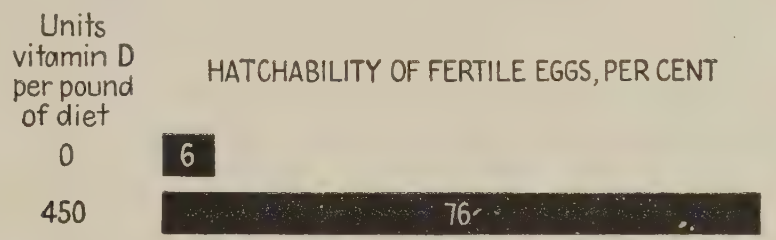


FIG. 107.—Supplementing a diet deficient in vitamin D increased hatchability of fertile eggs from 6 to 76 per cent. (*Graph made from data of L. A. Wilhelm, E. I. Robertson, and M. Rhian, Washington Experiment Station.*)

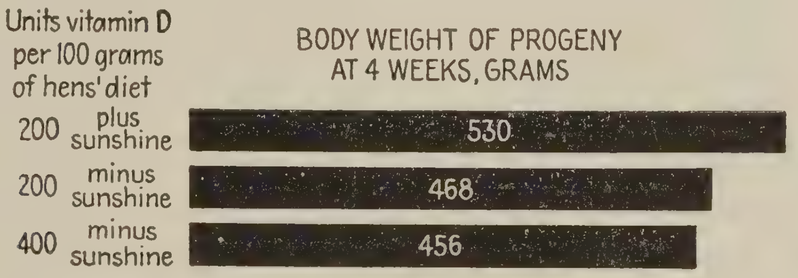


FIG. 108.—Breeding hens having access to sunlight and fed a diet supplemented with 200 vitamin D units from cod-liver oil per 100 grams of diet produced poults that weighed more at 4 weeks than breeding hens receiving the same or higher levels of vitamin D units from cod-liver oil but without access to sunlight. (*Graph made from data of E. I. Robertson, M. Rhian, and L. A. Wilhelm, Washington Experiment Station.*)

flock of the same variety when the diet was supplemented with 450 vitamin D units per pound of diet. Figure 107 shows the disastrous affect on hatchability of a diet seriously deficient in vitamin D.

The beneficial effects of irradiation from sunshine when breeders are given access to sunlight are apparently indicated by the more rapid growth of their poults during the first 4 weeks as compared with poults secured from breeders not having access to sunlight, as shown in Fig. 108. The poults secured from the three groups of breeders were fed a diet supplemented with 200 units of vitamin D from cod-liver oil per 100 grams of diet.

The formulas given in the next few pages for turkey breeding stock indicate the proportions of various ingredients that should be used to balance the diet properly with respect to protein, minerals, and vitamins.

Preparing Diets for Breeding Stock. Since breeders consume considerable quantities of feed and since the cost of feed is by far the most important factor in producing hatching eggs, it is very necessary to provide breeders with the best kind of diet that can be prepared in order to produce hatching eggs as economically as possible. The following are the approximate pounds of feed consumed per hen per month during the breeding season: Broad-breasted Bronze, 17 to 19; Standardbred Bronze, 16 to 18; Black and other varieties of similar size, 14 to 16; Beltsville Small-type White, 11 to 13. The actual amount consumed depends partly on the size of the birds in any flock and the kind of diet fed. Using these figures, estimate the approximate amount of feed your breeding flock will require during the breeding season.

Young hens that have been saved for breeders after the other birds have been marketed are still growing and must be fed liberally to provide for continued growth and for good egg production when laying commences. Young toms saved for breeders are also still in the growing stage and require liberal feeding. Under normal conditions during the breeding season toms lose from about 16 to 25 per cent of their weight and hens lose from about 12 to 18 per cent of their weight, depending upon their relative size. It is important, therefore, that breeding toms and hens be in prime condition at the beginning of the breeding season.

Start feeding breeding stock their egg-producing diet at least 1 month before you want them to start laying. As explained in Chap. 2, artificial lighting stimulates early egg production and increases fertility in the first eggs laid.

For feeding mashes, provide 1 linear foot of hopper feeding space per three or four birds, depending on the variety. Use hoppers for whole grain, as well as mash, that prevent wastage of feed and that keep the birds from getting their feet into the hoppers, which contaminates the feed. Never feed whole grain on the floor.

Have clean water available at all times. If you live in a section of the country where the water freezes during very cold weather, use an electric heater to keep the water from freezing or install running water with an automatic fountain. If electricity is not available, provide warm water sufficiently often during cold spells so that turkeys can always get a drink. Place the water container on a wire platform to help keep the litter dry.

The following diets have given good results and are submitted as typical diets recommended by various state experiment stations and the U. S. Department of Agriculture. If you plan to mix your own

TABLE 23. MASHES FOR TURKEY BREEDING STOCK, POUNDS PER TON
(California Experiment Station, 1944)

Feedstuff	Containing 20 per cent protein*			Containing 30 per cent protein†	
	I	II	III	I	II
Fish meal	300	160	100	360	200
Meat meal	0	0	100	0	200
Soybean meal‡	0	300	280	720	680
Dried whey or equivalent§	50	100	100	200	200
Alfalfa meal‖	300	300	300	500	500
Bone meal or equivalent¶	40	50	40	80	80
Ground limestone or equivalent**	40	40	40	80	80
Salt, iodized	20	20	20	40	40
Vitamin D carrier, 400 D††	10	10	10	20	20
Wheat bran or mill run	300	300	300	0	0
Ground grains	940	720	710	0	0
Totals	2,000	2,000	2,000	2,000	2,000

* To be fed with approximately equal quantities of whole grain. These mashes contain about 20 per cent crude protein, 2.4 per cent calcium, and 1.1 per cent phosphorus.

† To be fed with approximately three parts of whole grain. These mashes contain about 30 per cent protein, 4.5 per cent calcium, and 1.5 per cent phosphorus.

‡ Linseed meal may be substituted for soybean meal at levels of 4 per cent in the low-protein mashes, and of 6 per cent in the high-protein mashes.

§ Dried whey or other riboflavin carrier (dried skim milk, fermentation by-products, etc.) having 30 micrograms of riboflavin per gram or proportionate amounts of different guaranteed potencies.

‖ Fresh greens should be fed whenever available at the rate of 20 to not more than 50 per cent by weight of the mash and grain intake, or about 10 to 30 lb. to each 100 birds daily. If a regular supply of fresh alfalfa or other greens is available, the alfalfa meal in the mashes may be reduced by one-third and the ground grains correspondingly increased.

¶ Steamed bone meal, sterilized raw bone meal, spent bone black, dicalcium phosphate, or defluorinated rock phosphate.

** Ground limestone, oystershell, clamshell, calcite, or equivalent calcium carbonate carrier of suitable poultry-feeding grade. It is suggested that a manganese carrier be premixed in the calcium carbonate in an amount equivalent to 4 oz. of manganese sulphate or 3 oz. of precipitated manganese carbonate per 40 lb. of calcinm carbonate carrier.

†† Or proportionate amounts of poultry vitamin D carriers of different guaranteed potencies. The amount recommended does not fully meet the birds' needs; hence during prolonged periods of wet or foggy weather the vitamin D carrier should be doubled.

breeder mash and scratch grain, write to the poultry department of your state college of agriculture, listed in the Appendix, and get recommended formulas.

In sections of the country where green feed is readily available turkey breeding stock is able to secure certain nutrients, especially vitamins, that are apt to be lacking in diets for turkeys in northern sections, where the breeding stock naturally must be kept confined during the breeding season. When breeding stock is confined it must be provided with a well-balanced laying mash and plenty of tender green feed. Scratch grain, clean water, oystershell, and grit must also be provided. If succulent green feed is not available, a special turkey breeder diet, fortified with supplements of the more important vitamins, should be fed from the beginning of the breeding season. The following mashes have given good results.

TABLE 24. MASHES FOR TURKEY BREEDING STOCK, POUNDS PER HUNDRED
(Oklahoma Experiment Station, 1942)

Ingredient	TP6	TR4	TS4*
Ground wheat	18		
Ground yellow corn or ground kafir	......	14	17
Pulverized barley or oats	18	14	17
Wheat bran	18	30	17
Wheat shorts	18	14	17
Alfalfa leaf meal (dehydrated; 20 per cent protein)	8	7	10
Meat and bone scraps (50 per cent protein)	......	11	5
Cottonseed meal (42 per cent protein)	9	6	7
Soybean oil meal (42 per cent protein)	9	......	4
Dried buttermilk	......	2	4
Pulverized oystershell or limestone	1	1	1
Salt	1	1	1
Fish-liver oil (400 D)	0.25	0.25	0.25
Totals	100.25	100.25	100.25

* Ration TS4 is satisfactory for breeders without green feed, while TR4 will do for hens with limited amounts of green feed. If abundant green feed and some liquid milk are available throughout the breeding season, ration TP6 may be used with good results. Fish-liver oil or other vitamin D supplements should always be fed through the winter months. If ordinary fish-liver oil with 85 to 100 vitamin D units per gram is used in the above rations, 1 per cent is the correct amount.

For breeding stock that does not have access to green feed provided by succulent pasture, the formula in Table 25 is suggested.

Feed the scratch-grain portion of this diet at the rate of 1 lb. daily for every five turkeys, for at this rate the turkeys eat about the same amount of mash and scratch grain. The scratch grain may be fed in hoppers or sprinkled on top of the dry mash. For every

TABLE 25. A COMPLETE MASH AND SCRATCH-GRAIN DIET
(U.S. Department of Agriculture)

Mash	Parts by weight	Scratch grain	Parts by weight
Ground yellow corn	23	Yellow corn (or barley)	40
Middlings	20	Heavy oats	38
Bran	12	Wheat	20
Alfalfa leaf meal (dehydrated preferred)	10	Cod-liver oil (ordinary high-grade oil, not fortified) pints or pounds	2
Meat scrap (50 per cent protein)	8	Total	100
Dried milk	10		
Fish meal (55–70 per cent protein	8		
Ground oystershell	8		
Salt	1		
Total	100		

five birds feed about ⅓ lb. in the morning and ⅔ lb. in the evening. Mix the cod-liver oil fresh every week or two, first mixing the oil with a small quantity of bran and then thoroughly mixing this bran with the rest of the mash ingredients.

TABLE 26. MASHES FOR MASH-AND-SCRATCH-GRAIN DIETS FOR BREEDING STOCK, POUNDS PER HUNDRED
(Kansas, Nebraska, and West Virginia Experiment Stations)

Ingredient	Kansas		Nebraska		West Virginia
	No. 1*	No. 2†	No. 1	No. 2‡	
Ground yellow corn	20	20	21	30	25
Standard wheat middlings	...	...	...	...	20
Shorts or ground wheat	20	20	20	20	
Wheat bran	11	17	10	10	10
Ground heavy oats or barley	20	20	10	10	10
Alfalfa leaf meal	10	5	20	20	10
Fish meal	5	5	5	2	15
Meat scrap	5	5	5	2	
Dried-milk products	...	...	...	...	5
Soybean meal	5	5	5	2	
Ground limestone or oystershell	2	2	2	2	2
Salt	1	1	1	1	1
Cod-liver oil	1	0	1	1	2
Total	100	100	100	100	100

* For breeders confined.

† For breeders on range.

‡ A suitable mash when skim milk is available as a drink.

Feed each mash in Table 26 with a scratch-grain mixture made up of corn, wheat, and oats or substitutes such as Kafir and millo millet in any combination desired. At least three grains are preferable to one or two grains. Feed a sufficient amount of the scratch-grain mixture so that the turkeys will consume approximately the same quantity of mash and scratch grain daily. Number 2 Nebraska mash is suitable where skim milk can be kept before the birds at all times. The West Virginia mash should be supplemented with alfalfa hay or other green feed fed in racks. With all mashes listed above, keep oystershell or medium-fine limestone and granite grit available in separate hoppers.

Some turkey growers prefer to feed an all-mash diet because of the labor saved in feeding and because every bird in the flock is assured a balanced diet.

TABLE 27. ALL-MASH BREEDING STOCK DIETS, POUNDS PER HUNDRED
(West Virginia Experiment Station, and U.S. Department of Agriculture)

Ingredient	W. Va.	U.S.D.A.	
		No. 1	No. 2
Coarsely ground yellow corn	35	30	30
Standard wheat middlings	20	24.5	21.5
Ground heavy oats	15	20	20
Wheat bran	10	6	5
Alfalfa leaf meal, bright green	5	4.5	5
Dried milk	3	4	5
Fish meal (60–70 per cent protein)	8	2.5	3
Meat scrap (50 per cent protein)	.....	3.5	4
Ground oystershell	2.5	3.5	4
Salt	.5	.5	.5
Cod-liver oil (85 to 100 D units per gram)	1.0	1.0	2
Total	100	100	100

These all-mash diets require no other feed except insoluble grit. Feed a sufficient amount of mash each day so that the birds will consume approximately the same quantity from day to day, except that as egg production increases relatively more mash is consumed. Use freshly mixed mashes because the vitamin A and D potency decreases the longer the mashes have been mixed, especially in warm weather.

Hatchability is improved when the breeding stock has access to sunshine and succulent green pasture. Rye, wheat, oats, or vetch could be sown in the fall to provide pasture in the spring or a good grass or legume pasture could be used, providing the breeding stock is removed as soon as the breeding season is over and the ground left idle for about 6 months. Keep the pasture in succulent condition by mowing or clipping, because grasses and legumes in a young growing stage are more palatable than in later stages of growth and they contain more nourishment. Double yards for each breeding pen or flock make it possible to maintain a constant supply of succulent green feed throughout the breeding season and help to prevent the soil from becoming contaminated with organisms of disease and eggs of parasites.

If you are not carrying on trap-nesting and pedigree-breeding work, sell your breeding stock as soon as the breeding season is over. Never allow adult turkeys to mix with poults. Selling the breeding stock as soon as the breeding season is over helps to break the cycle of infection of disease and parasites. If you are a pedigree breeder and have identified certain sires and dams that proved to be outstanding breeders so that you want to hold them over to another breeding season, give them a separate clean range, which provides abundant green feed, such as alfalfa, Ladino clover, a grass sod, or other succulent green feed and plenty of shade. Turkeys, especially males, are quite subject to heat prostration. Plenty of shade and well-ventilated roosting quarters are quite essential. Provide alternate yards for each flock, not only to keep the green feed in better shape but also to avoid soil contamination.

The summer and fall care of breeding stock that is carried over to another breeding season is a fairly simple matter. Separate the males from the females and feed them a grain mixture of 40 parts corn, 40 parts wheat, and 20 parts oats or suitable substitutes such as kafir and proso millet. Give them plenty of clean water and place the water containers on wire platforms to keep the soil from becoming contaminated.

3. Feeding the Poults

Most flocks of turkey poults consume too many pounds of feed per pound of gain in weight. This is because the poults are secured from breeding stock that was not bred for rapid growth and good fleshing, because improper diets are fed, because of poor flock management, or because of any two or all three of these factors.

Chapter 2 emphasized how important it is to secure poults from breeding stock selected for rapid growth and good fleshing and Chap.

4 discussed successful methods of flock management. It is important to learn how to prepare diets for poults and how to feed them so that they will utilize feed efficiently in converting it into turkey meat. Usually the fewer the pounds of feed consumed per pound gain in weight to marketing time, the greater the profits in raising turkeys.

Determining Relative Value of Different Feedstuffs. Before well-balanced diets can be prepared that will promote rapid growth and efficient utilization of feed, it is necessary to know something about the relative merits of the different kinds of feedstuffs used to supply the various nutrients needed by growing poults.

Cereals. The major portion of the diet for poults is made up of cereal grains and by-products of some of them, such as wheat bran

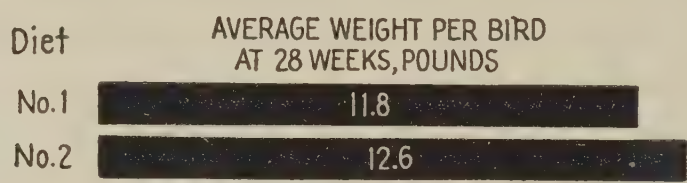


FIG. 109.—The mash of diet No. 1 contained 39 per cent ground yellow corn and the mash of diet No. 2 contained 41.5 per cent of ground wheat, otherwise the mashes were practically the same. The variety was Beltsville Small-type White. (*Graph made from data of J. C. Hammond, S. K. Haynes, S. J. Marsden, and H. W. Titus, U.S. Department of Agriculture.*)

and middlings. Yellow corn and wheat are the principal cereals used, although oats are used to a considerable extent, barley is used to some extent, and kafir, milo, and proso millet are used in some sections of the country as partial substitutes for some of the corn.

The data in Fig. 109 show that when ground wheat replaced ground yellow corn in the mash portion of the diet, the two diets otherwise being practically the same, the turkeys weighed 0.8 lb. more on the average at 28 weeks of age. During the first 8 weeks mashes only were fed and after 8 weeks cracked corn was fed ad libitum to each group. The birds in each group were Beltsville Small-type Whites.

The data in Fig. 110 show the average number of pounds of feed consumed per pound of gain in weight by Standardbred Bronze poults fed corn, wheat, barley, or oats as the principal cereal in the diet from 8 to 20 weeks. From the standpoint of efficiency of gains, corn and wheat were slightly superior to barley and oats, barley being slightly superior to oats.

The data in Table 28 show that when proso millet was used as a substitute for one-half or for all of the yellow corn in the diet of Standardbred and Broad-breasted Bronze poults, the birds weighed more on the average but consumed more feed and, therefore, used slightly more pounds of feed per pound gain in weight. These results show, however, that if proso millet costs less than corn it could be used as a substitute. During the first 8 weeks the second group of birds was fed a mash in which one-half of the ground yellow corn fed to the first group was substituted by ground proso millet and the third group was fed a mash in which all the ground yellow corn was replaced by ground proso millet. From 9 to 26 weeks similar sub-

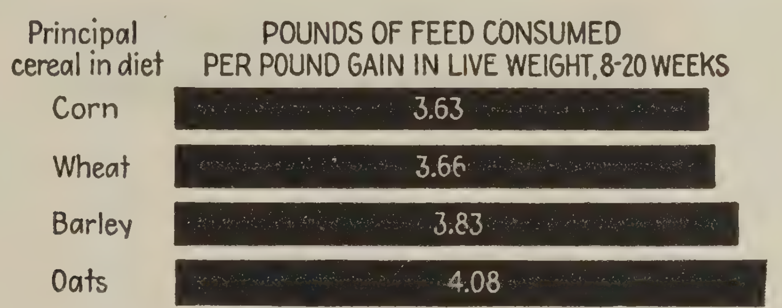


FIG. 110.—Corn and wheat each produced slightly more efficient gains than barley and oats when each grain was the principal cereal in the diet fed from 8 to 20 weeks. The variety was Standardbred Bronze. (*Graph made from data of W. E. Poley and W. O. Wilson, South Dakota Experiment Station.*)

stitutions were made in the growing mashes and in the whole-grain portion of the diet as indicated in Table 28.

TABLE 28. PROSO MILLET CAN BE SUBSTITUTED FOR PART OR ALL OF YELLOW-CORN PORTION OF DIET FOR TURKEYS

(G. P. Goodearl and F. E. Moore, North Dakota Experiment Station, 1941)

Percentage of each kind of grain in whole-grain portion of diet, 9–26 weeks	Yellow corn, 50 Wheat, 50	Yellow corn, 50 Proso millet, 25 Wheat, 50	Proso millet, 50 Wheat, 50
Average weight per bird, both sexes, at 26 weeks	14.8	15.1	15.8
Pounds of feed consumed per bird, 0–26 weeks	69.1	73.9	77.5
Pounds of feed consumed per pound gain in live weight	4.9	5.2	5.2

Protein Supplements. Animal protein supplements are usually relatively more expensive than vegetable protein supplements. In recent years much research has been carried on to determine the relative merits of the two groups of protein supplements. The data in Fig.

111 show that, with Beltsville Small-type Whites, soybean meal used as a protein supplement gave as good results as fish meal, meat scrap, and dried skim milk in mashes containing approximately equal quantities of protein, minerals, and vitamins.

Soybean oil meal proved to be slightly superior to corn gluten meal and cottonseed meal in promoting growth in Standardbred Bronze turkeys, as shown in Table 29. The basal diet contained the following parts by weight: yellow corn meal 42, wheat bran 15, wheat

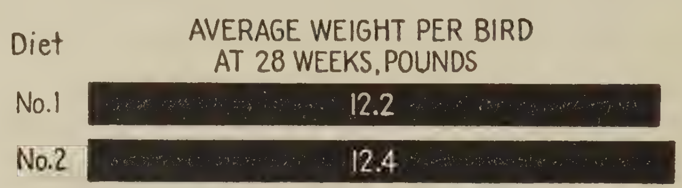


FIG. 111.—Diets No. 1 and 2 were practically the same, except that No. 1 contained 38.5 per cent soybean meal and No. 2 contained 14 per cent fish meal, 7 per cent meat scrap, and 7 per cent dried skim milk. Each mash contained approximately equal quantities of protein, minerals, and vitamins. After 8 weeks cracked corn was free-fed. (*Graph made from data of J. C. Hammond, S. K. Haynes, S. J. Marsden, and H. W. Titus, U.S. Department of Agriculture.*)

shorts 15, meat scrap 10, alfalfa leaf meal 5, dried milk 5, salt 1, and cod-liver oil 2, totaling 90. Three mashes were tested, one in which 10 parts of soybean oil meal, one in which 10 parts of corn gluten meal, and one in which 10 parts of cottonseed meal were added to the basal diet. The data in Table 29 show that the soybean-oil-meal group weighed more at 24 weeks than the other groups and that the corn-gluten-meal and cottonseed-meal groups were comparable in weight. The soybean-oil-meal group graded higher both as live and as dressed birds than the other two groups.

TABLE 29. AVERAGE WEIGHT PER BIRD AT 24 WEEKS OF AGE ON DIETS DIFFERING IN THEIR VEGETABLE PROTEIN SUPPLEMENT, STANDARDBRED BRONZE TURKEYS
(E. M. Funk and H. L. Kempster, Missouri Experiment Station, 1940)

Year	1937			1939	
Vegetable protein supplement	Soybean oil meal	Corn gluten meal	Cottonseed meal	Soybean oil meal	Corn gluten meal
Males, pounds	13.97	11.35	12.25	14.40	13.30
Females, pounds	9.70	8.50	9.05	9.70	8.97
Both sexes,* pounds	11.83	9.93	10.65	12.05	11.14

* Both sexes assumed to be in equal numbers.

Using Standardbred Bronze turkeys, a comparison was made on growth to 12 weeks between a mash containing 10 per cent soybean oil meal and a mash containing 20 per cent soybean oil meal, as shown in Table 30. Each mash contained the following parts: wheat bran 15, wheat middlings 15, meat and bone scraps 10, dried skim milk 5, alfalfa leaf meal 5, ground limestone 1, salt 1, and sardine oil 2, which was discontinued after the poults had access to sunshine. To this mixture were added 36 parts ground yellow corn and 10 parts soybean oil meal to make up the 10 per cent soybean-oil-meal mash, and 26 parts ground yellow corn and 20 parts of soybean oil meal to make up the other mash. The 10 per cent soybean-oil-meal mash contained 20 per cent protein and the 20 per cent soybean-oil-meal mash contained 23 per cent protein.

TABLE 30. POUNDS OF FEED CONSUMED PER POUND GAIN IN LIVE WEIGHT BY STANDARDBRED BRONZE POULTS TO 12 WEEKS OF AGE IN RELATION TO METHOD OF REARING AND PER CENT SOYBEAN OIL MEAL IN DIET

(Roy E. Roberts, Indiana Experiment Station, 1940)

Method of rearing	Percentage of soybean oil meal in diet	Average weight per poult, at 12 weeks, pounds		Pounds of feed consumed per bird, both sexes	Pounds of feed consumed per pound gain in live weight
		Males	Females		
On range	10	4.05	3.48	11.87	3.27
	20	5.19	4.30	13.60	2.98
In confinement	10	3.83	3.16	10.54	3.12
	20	4.76	3.78	12.09	2.88

The data in Table 30 show that at 12 weeks of age the poults fed the 20 per cent soybean-oil-meal mash weighed more, consumed more feed per bird, but utilized feed more efficiently because they used fewer pounds of feed per pound gain in live weight than the poults fed the 10 per cent soybean-oil-meal mash.

It is also interesting to note that, for each kind of mash, poults reared on range weighed more, consumed more pounds of feed per bird and consumed more pounds of feed per pound of gain in weight than poults reared in confinement.

Turkey poults grow at a faster rate during the first few weeks than at any other time. For this reason the protein content of the diet needs to be relatively high during this fastest growing period and gradually lowered as the turkeys approach the finishing period for marketing. In Table 31 are given the 28-week weights of four pens of toms and hens fed four mashes with different levels of protein during the period from 9 to 28 weeks. The four pens were fed a starting mash for 8 weeks containing 23 per cent protein. From the ninth to the nineteenth weeks pens 13, 14, and 16 were fed a mash containing 20 per cent protein and pen 15 was continued on the 23 per cent protein mash. For the finishing period, 20 to 28 weeks, pen 13 was continued on the 20 per cent protein mash, pens 14 and 15 were fed a 16 per cent protein mash, and pen 16 was fed a whole-grain mixture in addition to the 20 per cent protein mash. Since the toms in the four pens and the hens in the four pens weighed about the same at 28 weeks, it was concluded that mashes containing 20 per cent protein from animal and vegetable sources are satisfactory for raising turkeys from the eighth to the twentieth week.

Table 31. Weights of Standardbred Bronze Turkeys at 28 Weeks in Relation to Kind of Diet Fed

(T. T. Milby, R. G. Jaap, and R. B. Thompson, Oklahoma Experiment Station, 1942)

Kind of diet	Pen Number			
	13	14	15	16
Percentage of protein in starting mash, 0–8 weeks	23	23	23	23
Percentage of protein in growing mash, 9–19 weeks	20	20	23	20
Percentage of protein in finishing mash, 20–28 weeks	20	16	16	20*
Average weight of toms at 28 weeks, pounds	18.4	18.4	17.9	18.7
Average weight of hens at 28 weeks, pounds	11.7	12.0	11.7	11.9

* Pen 16, in addition to a 20 per cent protein mash, was also fed a whole-grain mixture.

Some turkey growers feed their poults an all-mash diet containing about 22 to 25 per cent protein the first few weeks, this being called a "starting" mash. Then a mash is fed containing a much higher percentage of protein plus whole grains in separate hoppers, the mash being called a "growing" mash. The data in Table 32 show that, regardless of the level of protein in growing mashes, when Standardbred Bronze poults were also fed whole grain, the number of pounds of feed consumed per pound of gain in weight from 17 to 30 weeks and from 9 to 32 weeks, respectively, varied but little. It is also shown in Table 32 that Beltsville Small-type Whites consumed approximately the same number of pounds of feed per pound gain in weight from hatching time to 24 weeks regardless of the protein level of the growing mashes fed. During the first 8 weeks all poults in all groups were fed a starting mash containing either 22 or 23 per cent protein. After 8 weeks the groups were fed growing mashes containing the protein levels indicated in Table 32 and whole yellow corn and oats separately.

TABLE 32. POUNDS OF FEED PER POUND GAIN IN WEIGHT IN RELATION TO PROTEIN CONTENT OF GROWING MASH FED AFTER EIGHTH WEEK

(E. M. Funk, Missouri Experiment Station, 1943)

Standardbred Bronze:				
Percentage of protein in growing mash	27	32	36	40
Pounds feed per pound gain in weight, 17–30 weeks	6.2	6.3	6.5	6.6
Percentage of protein in growing mash	22	27	31	39
Pounds feed per pound gain in weight, 9–32 weeks	5.4	5.6	5.5	5.7
Beltsville Small-type White:				
Percentage of protein in growing mash	23	32	36	40
Pounds feed per pound gain, 0–24 weeks	4.7	4.5	4.6	4.8

Experience has shown that the higher the protein content of the growing mash, relatively less mash is consumed in proportion to whole grain. This was demonstrated in the case of Broad-breasted Bronze turkeys, whether reared on range or in confinement, as shown in Table 33. Each of the six groups was fed a starting mash containing 22.9 per cent protein. Two groups were fed a growing mash containing 20.5 per cent protein, and the other groups were fed a growing mash containing 39.1 or 39.5 per cent protein. In addition to the growing mash each group was fed the following whole grains: group 1, wheat, yellow corn, oats, and barley separately; group 2, a mixture of 40 parts wheat, 20 parts yellow corn, 20 parts oats, and 20 parts barley; groups 3, 4, 5, and 6, wheat and oats separately.

The data in Table 33 show that when the growing mash contained 39.5 or 39.1 per cent protein, the percentage of mash in total feed consumed was much less than when the growing mash contained 20.5 per cent protein. After about 16 weeks, growth in turkey poults proceeds at a slower rate and less protein is required, so that poults naturally eat more whole grain and less mash. Therefore, as the turkey grows the cost per pound of feed consumed decreases.

It is interesting to observe that in the case of group 1 fed four whole grains separately, the ratio of their consumption was 44.0 wheat, 17.9 yellow corn, 7.3 oats, and 0.5 barley. In the case of groups 3, 4, 5, and 6, which were fed wheat and oats separately, the ratio of wheat to oats consumed was 52.3 to 20.6, 53.8 to 16.1, 50.2 to 7.8, and 20.6 to 13.4, respectively.

TABLE 33. PERCENTAGE OF MASH IN TOTAL FEED CONSUMED AND AVERAGE WEIGHT PER BIRD IN RELATION TO PERCENTAGE OF PROTEIN IN GROWING MASH
(E. I. Robertson and J. S. Carver, Washington Experiment Station, 1941)

Group	1	2	3	4	5	6
Protein in starting mash, per cent...	22.9*	22.9*	22.9†	22.9†	22.9‡	22.9*
Protein in growing mash, per cent..	39.5	20.5	39.1§	39.1	39.1	20.5
Mash of total feed consumed, per cent	30.3	56.5	27.1	30.1	42.0	66.0
Method of rearing..............	Range	Range	Range	Range	Conf.	Conf.
Feeding period, weeks...........	29	28	24	24	24	24
Average weight per bird, both sexes	22.2	20.8	18.9	19.3	18.8	18.2

* First to eighth week.
† First to fourth week.
‡ First to fifth week.
§ Consumption of growing mash was restricted by keeping mash hoppers closed except for 1 hr. each morning and 1 hr. each afternoon.

The data in Table 33 show that group 1 turkeys, fed a growing mash containing 39.5 per cent protein and four whole grains separately to 28 weeks, weighed an average of 1.4 lb. more than group 2 turkeys, fed a growing mash containing 20.5 per cent protein and a mixture of four whole grains. The 24-week weights of groups 3 and 4, which were reared on range, show that restricting growing-mash consumption apparently retarded growth slightly. The 24-week weights of groups 5 and 6, which were reared in confinement, show that group 5, fed 39.1 per cent growing mash, weighed an average of 0.6 lb. more than group 6, fed a 20.5 per cent growing mash. It is doubtful if any of these differences in weight are significant because of the variations that existed with respect to the kind of diet fed and method of rearing. The data show, however, that, when growing mashes contain a relatively high protein content, the poults automatically tried to balance their protein intake in relation to growth by eating relatively more whole grain. The important point to be kept in mind is the relative cost of feeding a growing mash containing a high level of protein as compared with a growing mash containing a lower level of protein.

The proportions of mash and whole grain consumed in relation to the protein content of starting and growing mashes are given in Table 34 in the case of seven groups of Standardbred Bronze turkeys. For the first 11 weeks the seven groups were fed starting mashes containing approximately 18, 20, 22, 24, 26, 28, and 30 per cent protein, respectively. From the second to and including the eleventh week all groups were fed equal parts cracked hard wheat and cracked yellow corn. Beginning at the twelfth week the seven groups were fed growing mashes containing approximately 18, 20, 22, 24, 26, 28, and 30 per cent protein, respectively, and a whole-grain mixture made up of 40 parts hard wheat, 40 parts whole yellow corn, and 20 parts heavy oats.

TABLE 34. POUNDS OF FEED, INCLUDING VARIOUS ITEMS, CONSUMED PER POUND OF GAIN IN WEIGHT TO PRODUCE STANDARDBRED BRONZE POULTS WEIGHING 15 POUNDS IN RELATION TO PROTEIN CONTENT OF GROWING MASH
(J. C. Hammond and S. J. Marsden, U.S. Department of Agriculture 1939)

Feed item	Approximate percentage of protein in the starting and growing mashes						
	18	20	22	24	26	28	30
Total feed	4.27	4.09	4.21	4.27	4.31	4.00	4.51
Mash	3.30	2.77	2.85	2.65	2.63	2.33	2.20
Whole grain	0.97	1.32	1.36	1.62	1.68	1.67	2.31
Protein	0.72	0.72	0.80	0.83	0.88	0.85	0.93
Animal protein	0.25	0.29	0.36	0.39	0.45	0.45	0.48

The data in Table 34 show that the ratio of mash to whole grain consumed varied inversely with the protein content of the starting and growing mashes. In other words, the higher the protein content of the mash, relatively more grain was consumed by poults in an attempt to adjust the protein content of their diet. The total protein and animal protein, supplied by dried buttermilk, meat and bone scrap, and Alaska herring fish meal, consumed per pound gain in body weight tended to increase as the percentage of protein in the mash increased. The data show that when mash and whole grain are fed ad libitum the tendency to eat more grain and less mash is not strong enough to stabilize the protein intake until the protein content of the mash reaches 26 to 30 per cent.

The percentage of protein of the total diet for poults should be approximately as follows: first 8 weeks, 25; ninth and tenth weeks, 24; eleventh and twelfth weeks, 23; thirteenth and fourteenth weeks, 22; fifteenth week, 21; sixteenth to twenty-third weeks reduced by 1 per cent each week, by which time it should be about 13 per cent, which level should be maintained until marketing time.

Feeding whole grain in hoppers in addition to mash enables the turkey to balance its protein requirements as it grows, but it should be kept in mind that the quality of the protein in the diet is very important. At least two or, better still, three cereals provide better quality protein than just one cereal. Animal protein supplements added to the mash, especially milk products and steam-dried fish meal, still further improve the quality of protein in the diet.

Vitamin D Deficiency Retards Growth and Produces Rickets. It has been pointed out in the fore part of this chapter that vitamin D is necessary for normal growth and for proper bone calcification. The data in Table 35 show the striking difference between poults fed no vitamin D supplement and poults fed diets supplemented with vitamin D. There were three groups of poults fed diets containing no vitamin D supplement, each group secured from dams fed different levels of vitamin D supplement. There were three groups of poults fed diets containing 200 A.O.A.C. chick units of vitamin D from cod-liver oil per 100 grams of diet.

TABLE 35. BODY WEIGHT AND SEVERITY OF RICKETS AT 2 AND 4 WEEKS OF AGE AMONG BROAD-BREASTED BRONZE POULTS ACCORDING TO THE LEVEL OF VITAMIN D FED THE POULTS AND THEIR PARENTS

(E. L. Robertson, M. Rhian, and L. A Wilhelm, Washington Experiment Station, 1941)

Level of vitamin D in breeding hens' diet*	Level of vitamin D in poults' diet*	Body weight, grams		Severity of rickets†	
		2 weeks	4 weeks	2 weeks	4 weeks
100	0	138	220	2 3	3.5
200	0	153	250	2.0	3.8
400	0	168	266	3.0	3.8
100	200	165	487	1.0	1.0
200	200	152	485	1.0	1.0
400	200	192	510	1.0	1.0

* A.O.A.C. chick units of vitamin D from cod-liver oil per 100 grams of diet.

† Score used to indicate severity of rickets was 1, normal, 2, slight rickets; 3, moderate rickets; 4, severe rickets.

When the 4-week weights of the poults fed diets containing no vitamin D supplement are compared with the 4-week weights of the poults fed diets supplemented with vitamin D, it is quite apparent that a deficiency of vitamin D in the diets of the poults retarded their growth perceptibly. Further, there were slight to moderate rickets at 2 weeks of age, approaching severity at 4 weeks. Poults secured from breeding stock fed 100, 200, and 400 A.O.A.C. chick units of vitamin D had a mortality of 17.2, 9.8, and 6.1 per cent, respectively.

Breeding birds fed 400 A.O.A.C. chick units of vitamin D per 100 grams of diet produced poults that grew faster during the first 2 weeks than the poults secured from breeders fed 100 and 200 A.O.A.C. chick units of vitamin D, but at 4 weeks there was relatively little difference among the three groups of poults secured from dams fed different levels of vitamin D. All three groups of poults fed diets supplemented with vitamin D were free of rickets.

Riboflavin Deficiency Retards Growth. Since riboflavin is called the "growth-promoting" vitamin, you would naturally expect that diets deficient in this important vitamin would retard growth. That such is the case is shown in Fig. 112.

In addition to the retarded growth in the groups of poults fed diets containing 180 and 240 micrograms of riboflavin per 100 grams

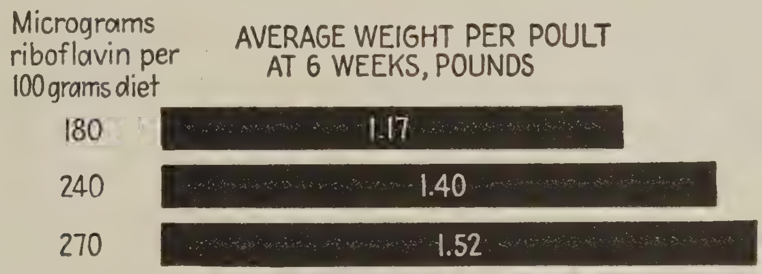


FIG. 112.—The data given here indicate why riboflavin is called a growth-promoting vitamin. (*Graph made from data of H. Patrick, M. I. Darrow, and C. L. Morgan, South Carolina Experiment Station.*)

of diet, it is of interest to note that perosis occurred in 32 per cent and 8 per cent of the poults, respectively, in the two groups. The poults fed 270 micrograms of riboflavin per 100 grams of diet had no perosis.

Preparing Diets for Poults. As previously stated, poults are fed starting mashes for about the first 8 weeks and growing or developing mashes for the rest of the season, except in some cases a finishing mash just prior to marketing time. Starting mashes usually contain about 24 to 26 per cent protein and growing or developing mashes about 20 per cent protein. Most flock owners feed nothing but starting mashes during the first few weeks, and when the poults are 4 or 5 weeks old cracked corn and whole wheat and oats are fed in hoppers or troughs. Use mash hoppers that prevent the poults from wasting the mash and never fill the hoppers or troughs more than two-thirds full to prevent wastage of feed.

Beginning at about 8 weeks, growing or developing mashes are fed along with whole grains, except that corn must be fed cracked.

A combination of three or more cereals is preferred. Make the change from starting to growing mashes gradually. In some cases, what is called a "concentrate protein mash," containing about 30 to 38 per cent protein, is fed instead of the regular growing or developing mash, the poults consuming relatively more of the whole-grain mixture in order to balance their protein requirements as growth proceeds.

Mash formulas recommended by some of the state colleges of agriculture are given in the following pages. They show the proportions of feedstuffs used to provide a proper balance of nutrients and also how to make substitutes in case certain feedstuffs are difficult to obtain. Mash formulas recommended by colleges in different sections of the country have been chosen in order to show the variety of feedstuffs that may be used. Although in most cases only one formula is given for each state, it should be made clear that most states mentioned recommend optional formulas. For the various formulas recommended by your state college of agriculture, consult the Appendix of this book for the address where to write.

Starting Diets. Feeding a good starting diet is very important because you want your poults to get a good start. Since nothing but mash is usually fed during the first 4 or 5 weeks, the mash must be complete from the standpoint of supplying the right kind of nutrients in proper proportions. Use fresh feedstuffs of good quality and mix up new batches of mash frequently so that none of the mash ever becomes stale. Remember that for the first few days poults usually do not have access to sunlight so that a vitamin D supplement is necessary to prevent rickets. Manganese sulphate should also be supplied as a supplement to prevent perosis. The proportions of cereal grains and their by-products used in starting mashes and the relative proportions of feedstuffs that supply protein, mineral, and vitamin supplements give some idea of the variety of combinations of feedstuffs that can be used.

In addition to the substitutes indicated in the formulas for these starting mashes, certain substitutions are recommended in the Texas formula in case it is impossible to secure the particular feedstuff mentioned or it is much higher in price than a substitute. Included are milo, kafir, millet, or rice for ground wheat; ground barley for ground oats; rice bran for wheat bran; cottonseed meal or peanut meal for soybean oil meal.

Be sure that all feedstuffs used in starting mashes are of as good quality and as fresh as can be secured. The quality of the alfalfa leaf meal (or alfalfa meal if it is used instead) is of the greatest importance because the carotene in alfalfa is a good source of vitamin A, providing the alfalfa was properly cured and the carotene content has not deteriorated seriously up to the time the alfalfa is mixed with the mash. Tender green feed should be supplied every day, especially if the poults are kept in confinement. During the first few days

TABLE 36. STARTING MASHES FOR POULTS

Feedstuffs	Texas	Iowa	South Carolina	Oklahoma	Oregon
Ground yellow corn	20	12	35	18‡	15
Ground wheat	13.5	...	...	...	16
Ground oats	15	30	...	18§	5
Ground barley	......	...	...	...	5
Wheat bran	8	10	...	...	15
Wheat middlings	......	...	20	18	
Soybean oil meal	12†	10†	10	10	
Peanut oil meal	......	...	7		
Cottonseed meal	......	...	...	10	
Meat scrap	......	15	5	10	10
Fish meal	14	10	7	...	9
Dried skim milk	5	5	...	...	5
Dried whey	......	...	5	...	5
Dried buttermilk	......	...	...	5	
Alfalfa leaf meal	8	5	8	10	10
Oystershell flour*	1.5	1	2	...	1
Steamed bone meal	2.5	...	...	...	0.25
Salt	0.25	1	1	0.5	1
Vitamin D carrier, 400 D	0.5	1	1	0.5	0.6
Total	100.25	100‖	101‖	100‖	97.85‖

* Or ground limestone.

† Or corn gluten meal.

‡ Or kafir.

§ Or ground barley.

‖ Add 4 oz. of manganese sulphate per ton of mash, mixing the manganese sulphate first with the oystershell flour.

sprinkle chopped green feed over the mash. In case the poults are allowed on range, be sure the pasture is kept in a succulent state by regular cutting. Sprinkle about 2 oz. of coarse sand or granite grit for each 100 poults over the top of the mash every day. For poults having access to sun porches or on range, the vitamin D supplement need only be about one-half that of poults kept in strict confinement. In fact, after the middle of June poults having access to sunshine do not need any vitamin D supplement.

If liquid milk is available on the farm for a limited number of poults being raised, it is possible to use less protein supplement in the mash, thus reducing the cost of the mash. On the other hand, although liquid milk is an excellent source of readily digestible nutrients, there are some objections to its use. If milk is spilled on the ground or left in the pans or troughs any length of time, flies are attracted and tend to increase tapeworm infestation. Also, when milk is spilled on the down or feathers of poults, they often start to pick one another's feathers and cannibalism sometimes results. Therefore, if liquid milk is fed be sure not to spill any and clean the milk vessels daily. Formulas for starting mashes for poults fed liquid milk are given in Table 37.

TABLE 37. STARTING MASHES FOR POULTS FED LIQUID MILK

Feedstuffs	Nebraska	Washington	Wyoming
Ground yellow corn	22.5	40	21.5
Ground wheat	....	14	10
Ground oats	10*	10	9*
Wheat bran	10	20	
Wheat shorts	20†	...	10
Alfalfa leaf meal	5	5	8
Soybean oil meal	5	...	28
Corn gluten meal	10	...	
Meat scrap	5	2	5
Fish meal	5	3	
Dried milk or whey	5		
Ground oystershell or limestone	1.5	3	2
Steamed bone meal	....	2	1
Salt	1	1	0.5
Fish oil (400 D)	0.5	...	0.5‡
Total	100.5	100	95.5

* Or barley.
† Or ground wheat.
‡ Omitted after 6 weeks if poults have access to sunshine.

Beginning about the fourth week, feed a mixture of equal parts cracked corn, whole wheat, and oats or barley in hoppers or troughs although for the first few days the mixture can be scattered on top of the mash. Beginning the fifth week, keep insoluble grit and oystershell in separate feeders before the birds.

Growing or Developing Diets. Beginning about the eighth week, change gradually from a starting mash to a growing or developing mash. Specimen formulas recommended by widely scattered state colleges of agriculture are given here as a general guide. Write to your state college, the address of which is given in the Appendix, for formulas recommended for your state.

TABLE 38. GROWING OR DEVELOPING MASHES FOR POULTS

Feedstuffs	West Virginia	U.S. Department of Agriculture	Michigan	Pennsylvania	Washington
Ground yellow corn	27	20	20	27.5	15
Ground wheat	...	...	...	.....	12.5
Ground oats	10	15	15	10	27
Wheat bran	15	10	15	15	17
Wheat middlings	15	15	15	15	
Soybean oil meal	12	10	15	16	5
Meat scrap	8	5	10	5	2
Fish meal	...	...	...	.....	8
Dried skim milk	4	10	5	2.5	
Alfalfa leaf meal	5	10	5	7.5	10
Ground limestone or oystershell	3	2	2	2	2.5
Steamed bone meal	...	2	1		
Salt	1	1	...	0.5	1
Total	100	100	103	101	100

The formulas given here for growing or developing mashes indicate the extent to which substitutions can be made. For instance, four formulas contain no ground wheat but do contain wheat middlings. Soybean oil meal can be used as a partial substitute for meat scrap, fish meal, and dried skim milk. Fish meal, if steam or vacuum dried, is usually preferable to meat scrap and in most cases could be used as a substitute for all the meat scrap in the mash, depending to some extent on the price of each.

These growing or developing mashes contain about 20 per cent protein and should be fed in conjunction with whole-grain mixtures or whole grains in separate hoppers, except that the corn should be fed as cracked corn up to about 16 weeks of age. Two or three grains are better than a single grain. As the turkey grows it eats relatively more grain and less mash because it needs relatively less protein in its diet.

Diets for poults reared in strict confinement in the absence of sunlight must be very carefully made up to see that adequate vitamins, especially vitamin D and to some extent vitamin A, and minerals are supplied and to be sure that the diet contains the proper ratio of calcium to phosphorus. Feed 5 to 10 lb. of succulent green feed per 100 poults every day. If poults have access to sun porches, be sure of the vitamin A content of the diet and the calcium-phosphorus ratio. If poults have access to a good range, they should be able to obtain plenty of succulent green feed and in the case of some formulas the amount of alfalfa meal or alfalfa leaf meal could be reduced. Keep oystershell and insoluble grit in hoppers for poults in strict confinement, on sun porches, and on range.

Some turkey raisers feed a growing mash containing a high protein content, with the result that relatively much more whole grain is consumed than when a 20 per cent growing mash is fed. Three specimen formulas are given in Table 39, together with a formula for a mash, containing about 16 per cent protein, to be fed without whole grain. This all-mash diet is reported to have produced satisfactory results.

TABLE 39. HIGH-PROTEIN CONCENTRATE MASH AND ALL-MASH FORMULAS

Feedstuffs	High-protein concentrate mashes			All-mash
	California, 35 per cent	Minnesota, 38 per cent	Wyoming, 33 per cent	Indiana, 16 per cent
Ground yellow corn	...	.....	...	65
Wheat middlings	...	.....	14	7.5
Wheat bran	13	10	...	7.5
Fish meal	27	21	3	
Meat scrap	...	17.5	9	4.5
Dried milk	...	12.5		
Soybean meal	30	17.5	40	13
Corn gluten meal	...	.....	10	
Alfalfa leaf meal	20	12.5	15	
Cane molasses	1	.....	...	1
Steamed bone meal	5	2	5	
Ground limestone	2	3	2	
Salt, iodized	2	2.5	2	0.5*
Vitamin D carrier (100 D)	...	1.5		
Granite grit (hen size)	...	.....	...	1
Total	100	100	100	100

* This is a salt mixture composed of nine parts iodized salt and one part manganese sulphate.

Some idea as to the amount of whole grains that should be fed with these high-protein concentrate mashes may be gained from the following number of pounds of whole grains recommended to be fed per 100 pounds of the California 35 per cent protein mash: 9 to 10 weeks, 150 lb. whole grains; 11 to 12 weeks, 200 lb.; 13 to 16 weeks, 250 lb.; 17 to 20 weeks, 300 lb.; after 20 weeks, 400 lb.

The Indiana all-mash diet for poults raised on sun porches should be altered by substituting 5 lb. of alfalfa leaf meal for 5 lb. of ground yellow corn. For poults having access to range, it is important that an abundance of succulent green feed be available at all times. If succulent pasture is not available throughout the growing season, temporary pasture crops should be provided by growing such crops as rape, soybeans, or Sudan grass during the hot summer months and rye for fall pasture.

Feeding Finishing Diets. Many turkey raisers feed growing or developing mashes until the poults are marketed. Such a practice is usually satisfactory, providing the poults have access to succulent green feed throughout the entire growing season and consume plenty of feed. However, since fish meal and especially fish feeding oil may produce fishy flavor in the flesh of the turkey, do not use fish meals in growing mashes for at least 12 weeks and cod-liver oil or other fish feeding oil for at least 14 weeks prior to the time the birds are killed for market. Other protein supplements such as dried milk, meat scrap, soybean oil meal, or corn gluten meal in proper amounts could be used as substitutes for the fish meal during the last 12 weeks prior to marketing time. If cod-liver oil or fish oil has been used as a source of vitamin A, it could be replaced by yellow corn or succulent green feed or both. If a vitamin D supplement is necessary during the latter part of the growing period for poults raised in confinement, an activated animal sterol compound could be used instead of cod-liver oil or a fish feeding oil.

Turkeys do not fatten well in hot weather. With the approach of cool weather in the fall, they eat more feed, and flesh and fat are deposited in abundance when they are fed a well-balanced diet and plenty of green feed is available. However, because of the possibility of green feed affecting the flavor of the flesh, discontinue feeding green feed about 3 days prior to killing time. If turkeys are thin in the fall, feed a good growing or developing diet minus fish meal and cod-liver oil or fish feeding oil. Or you could feed a fattening diet similar to the following one recommended by Kansas State College: 300 lb. white corn meal, 200 lb. pulverized oats, 100 lb. wheat shorts, 25 lb. meat scrap, and 25 lb. alfalfa leaf meal. Moisten this mash with liquid milk to a consistency of a paste and feed as much as the birds will consume in a half hour three times daily for about 3 weeks and give the birds liquid milk and water to drink.

To produce high-grade market turkeys, absence of short pin feathers is most important. Under ordinary circumstances young hens are not entirely free of pinfeathers before they are about 26 weeks old and young toms about 28 weeks old. In cool or cold weather, a mash well balanced with respect to proteins, minerals, and vitamins not only stimulates feather growth but gives the birds a splendid finished condition.

If a yellow finish is desired, use plenty of yellow corn and green feed but if a white finish is desired, use white corn, wheat, barley or oats or a mixture of these instead of most of the yellow corn and keep the level of ground yellow corn in the mash down to about 25 per cent. Up to within 3 days of killing time feed plenty of green feed to supply vitamin A needed. Milk in the diet tends to produce a white finish.

Feeding Pellets. Poults may be fed pellets instead of mash. Pellets are made by compressing dry mash in a pelleting machine heated by steam. The dry mash is fed into the hopper of the machine and is compressed under a pressure of about 60 tons, the compressed feed being forced through a die with holes of a certain diameter according to the size of the pellet desired and pellets of the desired length are cut by a revolving knife under the die. The pellets are dropped on a screen, which sifts out any meal, passed over a cooling device for about 30 min., and then sacked.

Pellets made from starting mashes for poults during about the first 8 weeks should be about ⅛ in. in diameter and ⅜ in. long. Pellets made from growing or developing mashes are usually made about ¼ in. in diameter and ¼ in. long. Some turkey raisers have found that feeding pellets to poults on range results in less wastage of feed from winds than when dry mashes are fed. In some cases it has been found that poults fed pellets have relatively fewer pinfeathers at marketing time than comparable poults fed dry mash.

It should be understood, of course, that cracked corn and whole wheat and other grains are fed in addition to pellets made from starting mashes during the first 8 weeks, just the same as in feeding dry mash. During the growing period, feed whole-grain mixtures or whole grains in separate hoppers in addition to the pellets made from growing mashes, just the same as in feeding starting mashes.

Adopting and Following a Good Feeding Program. You can feed well-balanced diets to poults and still get poor results because you did not adopt and follow a good feeding program. Great care and plenty of patience are necessary in teaching poults to eat and drink because they seem quite stupid. This is because they have very poor vision for about 1 week. Regularity in feeding is very important. Not only is fresh feed important but it must be kept as clean as possible to prevent the spread of disease. Water containers should be used that prevent the poults from contaminating the water with their droppings. The condensed outline of a feeding program in Table 40 will serve as a guide.

Additional details are given here, which if followed should enable you to secure good results in total number of pounds of turkey meat produced by your flock especially if mortality is kept at the minimum. Maintaining sanitary conditions to control mortality is discussed in the next chapter.

Feeding the First Week. Spread paper towels or other rough paper, or burlap sacking over the litter to keep the poults from eating the litter. Put the poults under the brooder about 24 hr. after the hatch is completed or as soon as you receive them from the hatchery. Feed and water them immediately. Use paper pie plates, egg-case flats, or shallow troughs made of laths or of wood strips 2 in. wide for the bottom and 1 in. wide on each side and end. Place these feeders partly under the outer edge of the canopy of the brooder. Place the water container, which should be rounded at the top to prevent the poults from standing on top of them to contaminate the water, partly under the edge of the canopy. For 150 poults provide 8 small water containers.

Dip the beak of each poult in water or milk and see that it swallows twice. Sprinkle finely chopped, tender green feed and rolled oats on top of the mash and spend some time encouraging the poults to eat. Putting a few bright-colored marbles on top of the mash encourages them to peck at the mash. If you want your poults to get a good start, you must be prepared to spend considerable time in teaching them to eat and drink or many of them may starve or at least be retarded because of lack of feed and water. In fact, lack of water during the first few days may cause slimy linings of the gizzards to develop. Turkey poults have very poor vision for the first few days, so you must take extra precautions to see that they eat and drink during this period.

Table 40. Condensed Outline of Feeding Program

Period	Mash	Scratch grain	Other items
First week	Starting mash or pellets. Sprinkle finely chopped fresh green feed and oatmeal on top of mash	None	Spread paper toweling or other rough paper or burlap sacking over litter. Use pie plates or troughs. Teach all poults to eat and drink. Provide plenty of feeding space and water containers
Second to seventh week	Starting mash or pellets. Continue sprinkling chopped green feed twice daily over mash. Sprinkle a little sand or insoluble grit on top of mash for about 5 weeks then feed in hoppers	Beginning about fourth week sprinkle chick-scratch grain over mash and about fifth week feed cracked corn, whole oats, and wheat in self-feeders	Remove paper toweling or burlap sacking. Be sure of no moldy litter. Increase size of feed troughs and water containers and put all on wire platforms. Provide mash troughs with beak cleaners. Encourage poults to use sun porch. For range rearing, move poults to range from 6 to 9 weeks, depending on season
Eighth week	Change gradually from starting to growing mash or pellets. Continue feeding green feed daily to confined poults	Increase size of cracked corn and feed whole oats and wheat or other cereals in self-feeders	Provide insoluble grit in hoppers. If birds on range, be sure no stagnant water is available
Ninth to twentieth week	Growing mash or pellets in hoppers. Stir mash frequently. For confined poults continue feeding fresh green feed twice daily	At about 16 weeks start feeding whole corn and continue with whole oats and wheat or other cereals in self-feeders	Increase size of feeders and water containers. Be sure mash hoppers have beak cleaners. Provide running water if possible. Avoid stagnant water. Provide grit and oystershell in hoppers. If poults on range, move all hoppers and water containers regularly and maintain succulent pasture by cutting or grow annual crops
Twenty-first week to marketing	Continue with growing mash or pellets or change gradually from growing to finishing diet. Use no cod-liver oil or fish oil for 12 weeks before marketing	Yellow corn and other cereals for yellow flesh finish and white corn, oats, and wheat for white flesh finish	Same as preceding section. Feeding a finishing diet is optional. If you have a limited number of turkeys and skim milk is available it could be used for fattening; milk tends to produce a white flesh

At the end of each day, remove the pie plates or egg-case flats and use clean ones the next day. That is the first step in providing sanitary conditions to control disease. Wash and disinfect the waterers daily and provide fresh water every day. At the end of 3 days replace the paper toweling covering the litter or turn the burlap sacking over. At the end of the first week the paper toweling or burlap sacking may be dispensed with. Be sure there is no moldy litter which the poults might eat.

Feening Second to Seventh Weeks. Begin using feeders about 4 in. wide at the bottom and 3 in. on the ends and sides. For 150

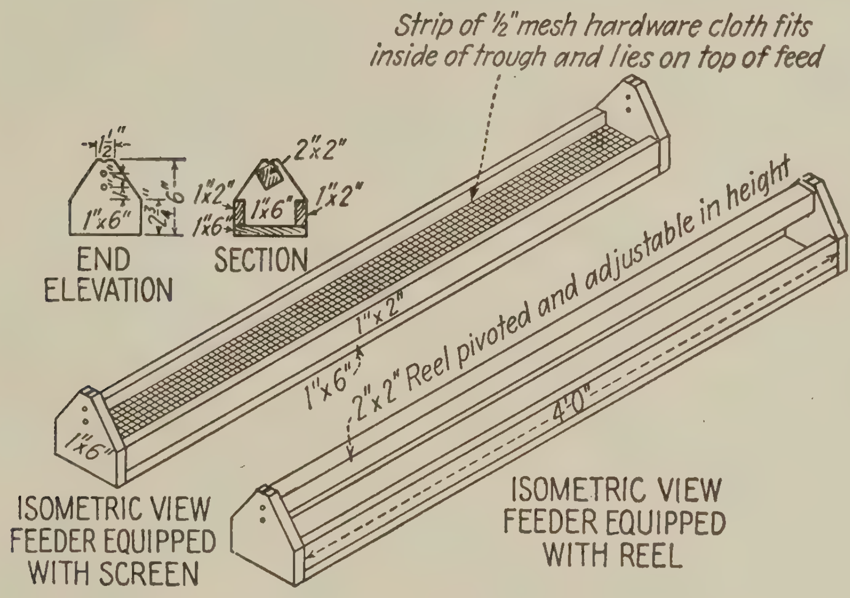


Fig. 113.—Working drawings of a type of mash hopper used for the first 6 weeks of the brooding period. (*H. M. Scott, Kansas Agricultural College.*)

poults provide at least four feeders each 2 ft. long and place them a little distance from the brooder. For 150 poults provide four fountains holding 2 gal. of water or three holding 3 gal. Feeders and water fountains should be put on wire platforms made of ¾ in.-mesh hardware cloth nailed to 1″ × 4″ pieces on edge. These platforms are a sanitary precaution against the spread of disease. Do not fill the feeders too full or considerable feed will be wasted. To permit week-old poults to reach the feeders and waterers, place a two-by-four flatwise along the edges of each wire platform. Be sure all poults learn readily how to get to the feeders and waterers in their new locations or mortality may result. If poults are allowed outside on range, be sure they do not have access to stagnant pools of water. Stir the mash in the feeders frequently and sprinkle finely chopped tender green feed on top of the mash at least twice daily. A little

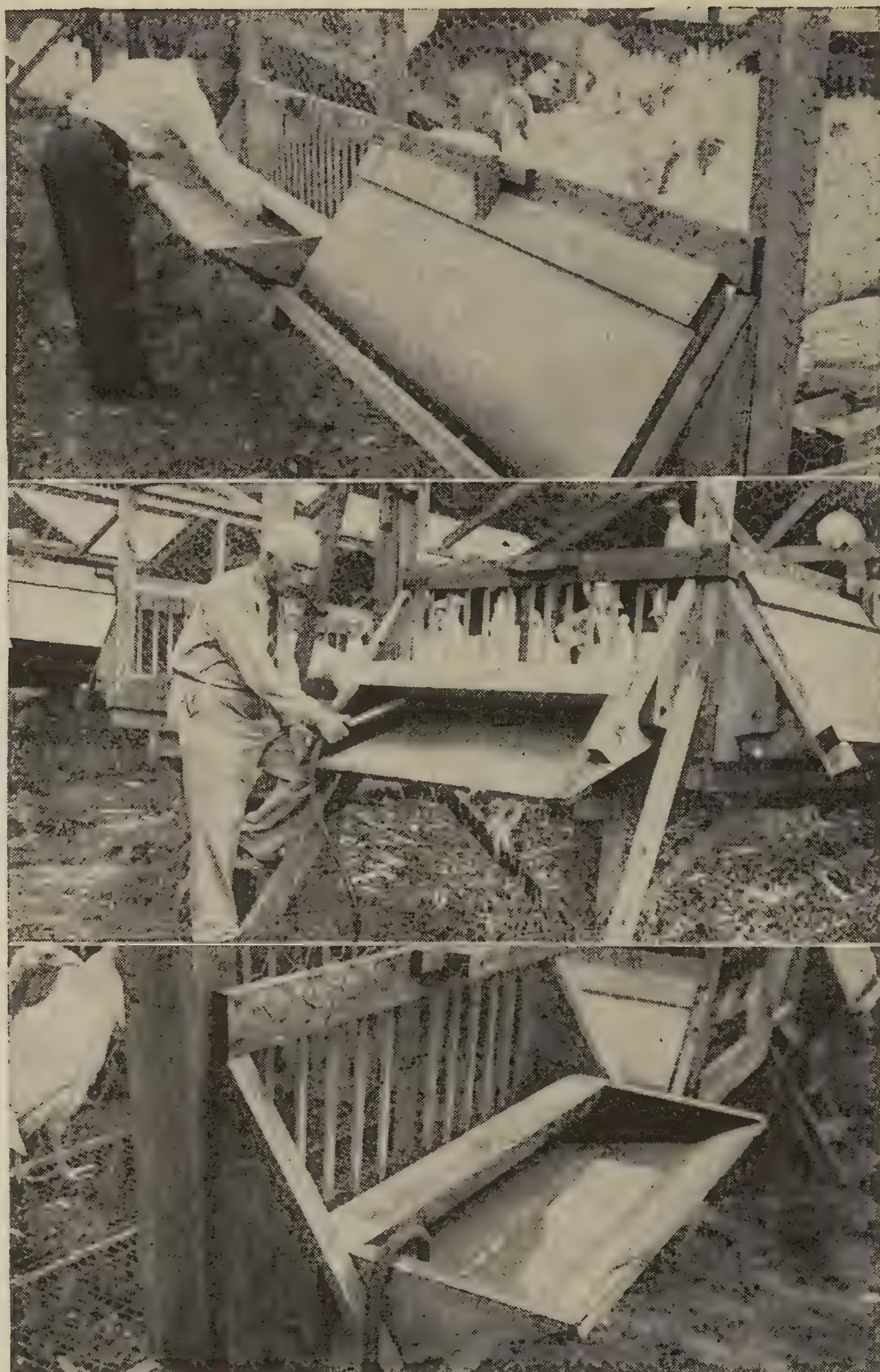


FIG. 114.—A practical hopper for use with a sun porch on Gilbert Hayes's farm in Massachusetts. Top, showing how easy it is to fill the hopper. Center, showing how easy it is to clean out the hopper. Bottom, the hopper used as a waterer by caulking and painting the joints. (*Gardner Osgood*, *Checkerboard News*.)

sand or fine insoluble grit may also be sprinkled on top of the mash. Begin to feed chick-size scratch grain in separate feeders located on wire platforms. Encourage the poults to use the sun porch in good weather, especially if the sun is shining.

Beginning about the fourth week, provide five feeders, 6 in. wide at the bottom, 4 in. high on the sides, and 3 ft. long, with a reel running lengthwise above the feeder to keep the poults out of the feeder. A wire stretched from end to end of each feeder makes a good beak cleaner and tends to keep the poults from picking at each other's feathers. A strip of ½ in. hardware cloth laid on top of the mash helps to prevent wastage (see Fig. 113). Feed medium-sized cracked corn and whole wheat and oats or other grains in two or three feeders each 3 ft. long. Continue to sprinkle finely chopped tender green feed on top of the mash, especially if your poults are confined to the house and sun porch. About 1 lb. of insoluble grit or sand sprinkled on top of the mash every third day is a good practice. About the fifth week 150 poults should be eating about 1½ lb. of grit per day.

Feeding the Eighth Week.. During the eighth week change gradually from starting mash to growing or developing mash and

FIG. 115.—Mash hopper for feeding poults after 12 weeks. (*S. J. Marsden and A. R. Lee, U.S. Department of Agriculture.*)

continue sprinkling green feed on top of the mash. Coarser cracked corn can be fed along with whole wheat and oats or other cereals in separate feeders. Provide at least four water containers holding 3 gal. each for 150 poults. Feed plenty of green feed.

Feeding Ninth Week to Marketing Time. Provide at least four feeders, each 6 ft. long, with 8-in. bottoms and 6-in. sides, equipped with beak cleaners, for 150 poults. Provide at least two feeders each 6 ft. long for grain. Use enough large-sized water containers to keep the poults supplied with fresh water at all times. If poults are on range, provide running water if at all possible because it saves so much labor hauling or carrying water. Never allow poults to drink stagnant water from puddles or ditches. Keep insoluble grit and oystershell in hoppers. At 12 weeks provide six 6-ft. mash hoppers with 12-in. bottoms and 10-in. sides equipped with beak cleaners and provide four 6-ft. feeders for grain. For information on maintaining a good supply of green feed for range birds throughout

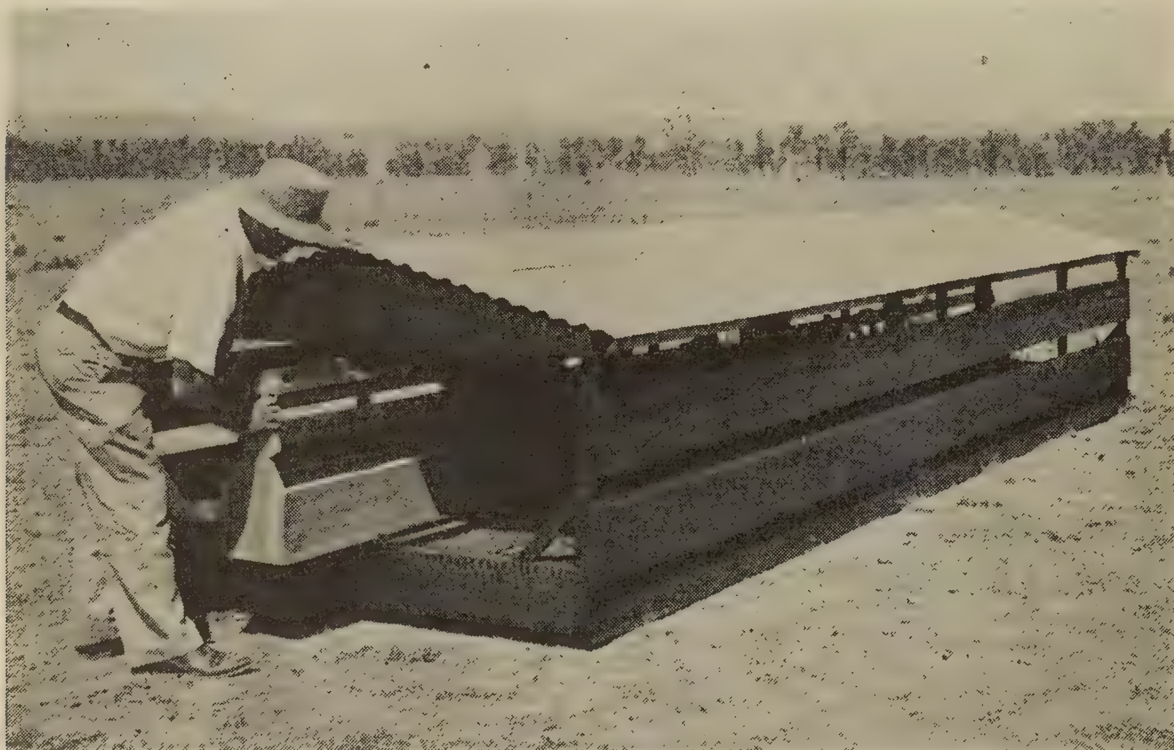


FIG. 116.—The style of feeder with cover protects the feed from rain and wind. (*S. J. Marsden, U.S. Department of Agriculture.*)

FIG. 117.—This is how a big operator moves his feeders on range. (*N. L. Bennion, Oregon Agricultural College.*)

the growing season see the latter part of Chap. 4. Move all feed hoppers and water containers frequently to avoid soil contamination, as explained in Chap. 4. If your poults are confined to the house and sun porch, continue feeding plenty of fresh green feed daily. At

16 weeks begin feeding whole corn along with other whole grains. Provide plenty of feeding space for whole grains, at least six 6-ft. feeders, because as the poults grow they consume relatively more whole grain and less mash, especially if a high-protein mash is fed.

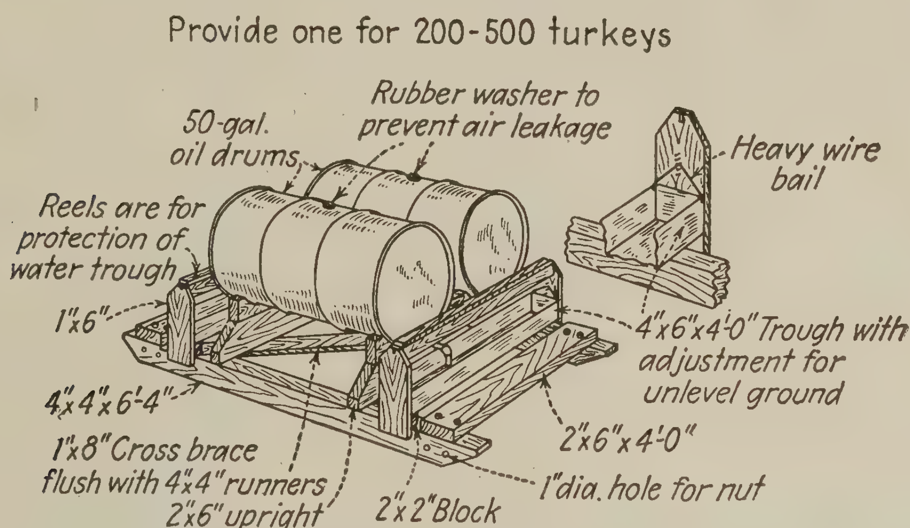


Fig. 118.—Portable range waterer made from two oil barrels. (*Iowa Experiment Station.*)

Fig. 119.—Keeping water available at all times is very important to promote regular gains in weight. (*W. A. Billings, Minnesota Agricultural College.*)

Feeding a special finishing mash for a few weeks prior to marketing time is optional.

At least 12 weeks before the poults are to be marketed, fish meal should be kept out of the mash and fish feeding oil for at least 14 weeks to avoid the possibility of fishy flavor in the flesh when the birds are served on the table.

4. Preventing Vices and Abnormalities

With the proper kind of a diet and good management, you should have practically no trouble from vices in your flock or from abnormalities that sometimes develop in some flocks. Nutritional deficiency diseases, due largely to inadequate supplies of certain vitamins, have already been discussed. In some flocks, especially if kept in close confinement and overcrowded, poults acquire certain vices that occasionally become quite serious.

Cannibalism. This results from severe picking that causes a flow of blood, but rarely occurs among flocks reared on range except in the case of fighting. It may occur occasionally among confined birds especially if any of them become injured. To prevent other birds from picking an injured poult, apply pine tar, scarlet balsam, or an anti-pick remedy, made up by mixing 4 oz. of vaseline with 1/4 oz. of carmine and 1/4 oz. of aloes, and keep the poult out of the pen until the wound is completely healed.

Feather Picking. This is a vice that develops in many turkey flocks and apparently may be due to any one of several causes. Overcrowding, especially when poults are reared on wire floors, seems to be one cause. In some flocks a dietary deficiency may be the cause. In most cases, however, the vice appears to develop from the natural tendency of poults wanting to wipe their beaks on other poults feathers, particularly the main tail feathers. If the vice becomes serious and continues until marketing time, many birds will have numerous pinfeathers or even blue backs if injured birds are exposed to sunlight. The vice rarely attains serious proportions among flocks reared on range with succulent green feed available at all times.

Preventive measures, especially for the confined flocks, include the following: (1) feeding fresh green feed daily; (2) feeding whole oats in self-feeding hoppers; (3) making sure there is enough fiber in the mash; (4) providing deep water containers so that mash sticking to the beaks washes off when the poults drink; (5) equipping all medium-sized and large-sized hoppers with beak-cleaning reels; (6) increasing the salt content of the diet to 2 or 3 per cent for a few days; (7) for young poults, darkening the brooder house by painting the windows with red lacquer or using ruby-colored electric bulbs; (8) removing about one-third of the upper beak with a sharp knife or with an electric device now on the market; (9) using pig rings or hog rings, depending on the age of the birds, as shown in Fig. 120. Saddles placed on birds with blue backs results in this disappearance of the dark pigment.

Abnormal Feathering. This abnormality rarely occurs in most flocks but may develop in a flock fed a diet too low in fiber content. Also, when poults are fed corn only, the plumage becomes ruffled and

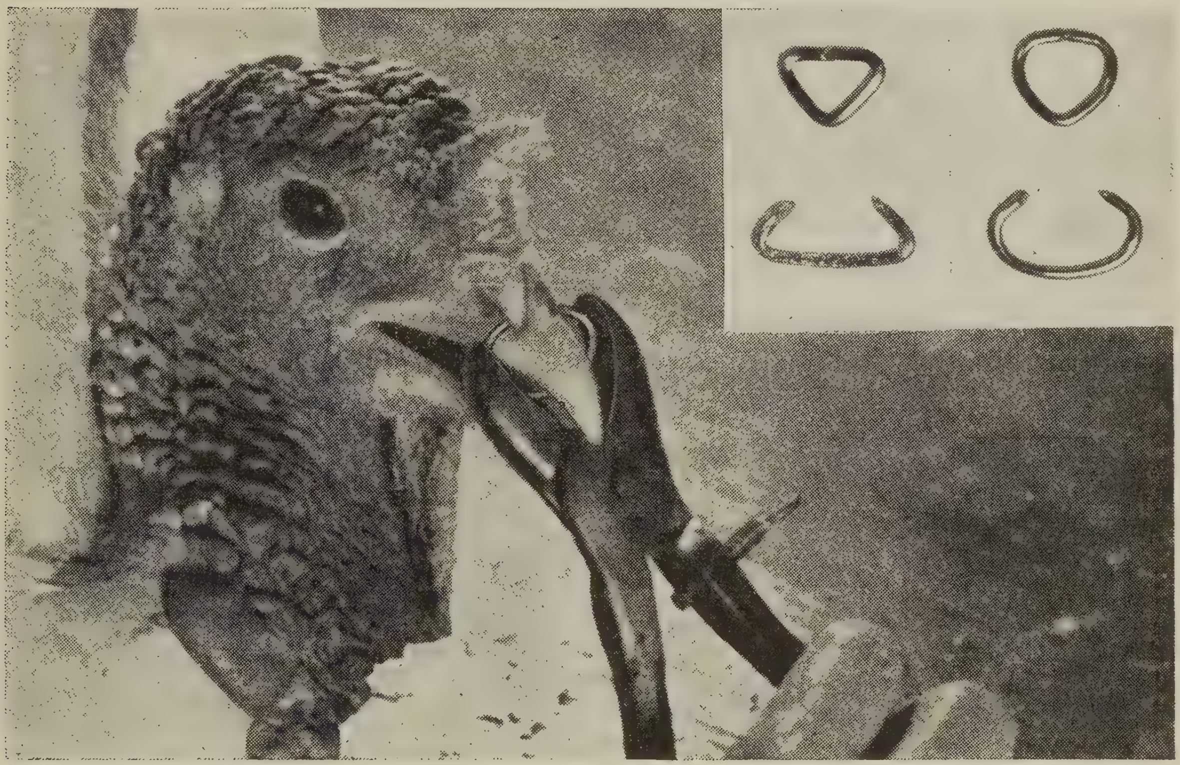


Fig. 120.—Pig rings to prevent feather picking. Upper right-hand corner: left, size of ring to 12 weeks; right, size of ring from 13 weeks to maturity. (*S. W. Hamilton, The Beacon Milling Co., Inc.*)

the feathers do not develop properly. Feeding oats or wheat bran prevents the trouble. Birds reared on range seldom have the trouble.

Crooked Keels or Breastbones. These are objectionable in dressed turkeys because of their appearance. If the abnormality is serious enough in live turkeys the market price is sometimes lowered. The wrong kind of roosts may apparently result in keel deformity, but faulty diets appear to be the principal cause. Deficiency of vitamin D, especially in the case of birds raised in confinement, and an improper balance of the calcium-phosphorus ratio may result in crooked keels. From the nutritional standpoint, every precaution should be taken to provide a well-balanced diet, particularly for birds raised in semiconfinement.

Pendulous Crop. The crop becomes enlarged and baggy due to weakened muscles. The trouble may sometimes be due to turkeys' consuming too much water in hot weather or the feeding of liquid milk in addition to water. Other factors causing this condition are discussed in Chap. 6.

5. Determining Pounds of Feed per Pound Gain in Weight

Most flocks of growing turkeys consume too many pounds of feed per pound of gain in weight. That is why in so many cases turkey raisers do not secure as good returns from their flocks as they should, since the cost of feed represents over one-half of total costs of raising turkeys for market.

Now that we have discussed how turkeys should be fed to secure rapid growth and efficient utilization of feed, you will be interested in learning the weight that well-bred turkeys properly managed should be expected to attain at different ages, the average number of pounds of feed consumed per bird, and the average number of pounds of feed per pound of gain in weight. Use the data given in the following pages as a basis of comparison with similar data pertaining to your flock.

Figure 12, in Chap. 1, shows that toms utilize feed more efficiently than hens because they grow faster. As a matter of fact, the toms consumed practically the same number of pounds of feed per pound gain in weight up to 28 weeks as did the females up to 24 weeks, although the toms averaged 28.1 lb. at 28 weeks and the hens averaged 14.1 lb. at 24 weeks. Hens of the same variety fed and managed the same are usually ready to be marketed somewhat earlier than the toms. Turkey raisers with large flocks might find it advantageous to separate the sexes at about 16 weeks and raise them separately thenceforth. It is possible to secure sex-separated poults from certain hatcheries so that the males could be raised separate from the females during the entire growing season.

The data in Fig. 12 show that as turkeys increase in size, more pounds of feed are required to produce each successive pound of gain in weight. Naturally, therefore, you want your birds to reach market condition relatively early so that they will use as few pounds of feed as possible in producing each pound of gain in weight, but at the same time unless they are in prime market condition and practically free of pinfeathers you cannot expect to obtain top market price. Keep in mind the fact that as turkeys increase in size they tend to consume relatively more grain and less mash so that as the birds approach marketing time the cost of feed to produce a pound of gain in weight is relatively less than somewhat earlier.

Turkeys reared in confinement usually consume slightly more pounds of feed per bird and per pound gain in weight than turkeys raised on range. This is shown to be true from 12 to 24 weeks of age in the case of Standard bred Bronze poults fed mash only and in the case of birds fed mash and grain, the data being given in Table 41. The four lots of turkeys were fed a mash containing 20.8 per cent

FIG. 121.—Poults harvesting sorghum. They also obtain considerable quantities of feed when given access to fields of wheat stubble and rice stubble. (*W. O. Wilson and W. E. Poley, South Dakota Experiment Station.*)

protein made up of 48 parts yellow corn, 15 parts wheat middlings, 10 parts meat and bone scraps, 20 parts soybean oil meal, 5 parts alfalfa leaf meal, 1 part salt, and 1 part ground limestone. The grain mixture for the two lots fed grain in addition to mash consisted of equal parts cracked corn and wheat changed gradually to whole corn.

Although the data in Table 41 show that on both kinds of diet slightly less feed was consumed per pound of gain in weight when turkeys were reared on range than when they were confined, you should remember that under average conditions losses from mortality, predatory animals, and other causes are usually greater among range-reared birds than among confined birds. The data in Table 41 also show that in this particular experiment relatively fewer pounds of feed were consumed per pound of gain in weight with the mash-and-grain diet than with the mash diet.

TABLE 41. POUNDS OF FEED CONSUMED PER POUND GAIN BY STANDARDBRED BRONZE POULTS FROM 12 TO 24 WEEKS IN RELATION TO METHOD OF REARING AND KIND OF DIET FED

(Roy E. Roberts, Indiana Experiment Station, 1940)

Kind of diet	Method of rearing	Average weight per poult at 24 weeks, pounds		Pounds feed consumed per bird, both sexes, 12–24 weeks	Pounds feed consumed per pound gain, 12–24 weeks
		Males	Females		
Mash	On range	14.38	9.82	40.00	5.19
	In confinement	13.81	10.38	44.64	5.41
Mash and grain	On range	14.65	9.87	34.33	4.41
	In confinement	13.83	10.01	40.76	5.03

The data in Table 42 show that in the case of Broad-breasted Bronze and Beltsville Small-type White poults, range-reared birds consumed fewer pounds of feed per bird and per pound of gain in weight than confined birds.

TABLE 42. POUNDS OF FEED CONSUMED PER POUND GAIN BY BROAD-BREASTED BRONZE AND BELTSVILLE SMALL-TYPE WHITE POULTS TO 26 WEEKS IN RELATION TO METHOD OF REARING

(M. I. Darrow and C. L. Morgan, South Carolina Experiment Station, 1944)

Variety	Method of rearing	Average weight per poult, both sexes, 26 weeks	Pounds feed consumed per bird, both sexes, 0–26 weeks	Pounds feed consumed per pound gain, 0–26 weeks
Broad-breasted Bronze	On range	17.96	71.36	4.00
	In confinement	17.08	74.59	4.37
Beltsville Small-type White	On range	12.54	54.57	4.39
	In confinement	12.71	57.13	4.53

From the data in Table 42 it is evident that in this experiment the Broad-breasted Bronze poults were relatively more efficient in feed utilization than the Beltsville Small-type White poults. At the same time, keep in mind the relative price of turkeys of different sizes, because many families prefer a dressed turkey of medium to small size. Small-sized varieties like the Beltsville Small-type White are usually ready to market at a relatively younger age than most large-sized varieties.

In Table 43 data are given on the pounds of feed consumed per pound of gain in weight by Broad-breasted and Standardbred Bronze and Beltsville Small-type White turkeys at 24 weeks of age and by Broad-breasted and Standardbred Bronze turkeys at more advanced ages, all of the birds having been reared on the range.

TABLE 43. POUNDS OF FEED CONSUMED PER POUND OF GAIN IN LIVE WEIGHT AT 24, 28, AND 32 WEEKS, RESPECTIVELY, ACCORDING TO VARIETY, ALL RAISED ON RANGE

Age, weeks	Variety	Source of data	Average weight per bird, pounds	Pounds feed consumed per bird	Pounds feed per pound gain
24	Broad-breasted Bronze	California*	15.43	68.35	4.50
		South Carolina†	15.68	60.43	3.85
		Wyoming‡	17.30	62.90	3.64
	Standardbred Bronze	U.S. Department of Agriculture§	14.69	56.28	4.05
	Beltsville Small-type White	California*	10.99	55.16	5.10
		South Carolina†	11.19	47.31	4.23
28	Broad-breasted Bronze	California*	18.45	87.72	4.84
		Washington‖	22.25	100.70	4.52
		Wyoming‡	20.1	86.40	4.30
	Standardbred Bronze	U.S. Department of Agriculture§	16.92	73 35	4.59
32	Standardbred Bronze	U.S. Department of Agriculture§	18.66	92.28	5.15

* V. S. Asmundson and T. H. Jukes, California Extension Service, 1944.
† M. I. Darrow and C. L. Morgan, South Carolina Experiment Station, 1944.
‡ M. O. North, Wyoming Extension Service, 1943.
§ S. J. Marsden, U.S. Department of Agriculture, 1940.
‖ E. I. Robertson and J. S. Carver, Washington Experiment Station, 1941.

From this table you can estimate the approximate number of pounds of feed required by your flock if it is any one of these three varieties and if it is to be reared on range. From the data in Tables 41 and 42 it is apparent that you could add about 5 to 15 per cent to this estimate if your flock is to be reared in confinement. Other varieties, such as the Black and White Holland, would usually consume slightly less than the Standardbred Bronze at any given age.

Tables 44 and 45 have been prepared for those who may want to know the approximate number of pounds of feed required for a flock for different periods during the growing season. Data are given for Broad-breasted Bronze and Beltsville Small-type White turkeys because these two varieties represent extremes in size.

In Table 44 it is shown that at the end of 28 weeks the Broad-breasted Bronze turkeys averaged 20.1 lb., both sexes, and the feed consumption averaged 86.4 lb. per bird. Run down the figures in the second column from the right and see how the number of pounds of feed consumed per pound gain in live weight per 2-week periods increased until it reached 8.7 lb. for the twenty-seventh- and twenty-eighth-week period. Note also in the right hand column of figures that, as the turkeys increased in age, the number of pounds of feed consumed per pound of gain in live weight steadily increased, until it reached 4.3 lb. at the end of the twenty-eighth week.

TABLE 44. AVERAGE WEIGHT PER BIRD AT END OF EACH 2-WEEK PERIOD, POUNDS FEED CONSUMED PER BIRD, AND POUNDS FEED CONSUMED PER POUND GAIN IN LIVE WEIGHT FOR DIFFERENT PERIODS IN BROAD-BREASTED BRONZE TURKEYS
(M. O. North, Wyoming Experiment Station, 1943)

Period, weeks	Average weight per bird at end of period, both sexes	Pounds feed consumed per bird per 2-week period	Pounds feed consumed per bird to end of period	Pounds feed consumed per pound gain in live weight per 2-week period	Pounds feed consumed per pound gain in live weight to end of period
1– 2	0.5	0.4	0.4	1.3	1.3
3– 4	1.2	1.2	1.6	1.7	1.6
5– 6	2.1	2.1	3.7	2.3	1.9
7– 8	3.4	3.0	6.7	2.3	2.1
9–10	5.0	3.9	10.6	2.4	2.2
11–12	6.7	4.8	15.4	2.8	2.4
13–14	8.5	5.8	21.2	3.2	2.6
15–16	10.3	6.8	28.0	3.7	2.8
17–18	12.3	7.6	35.6	3.8	3.0
19–20	14.1	8.2	43.8	4.6	3.2
21–22	15.7	9.0	52.8	5.6	3.4
23–24	17.3	10.1	62.9	6.3	3.7
25–26	18.7	11.3	74.2	8.0	4.0
27–28	20.1	12.2	86.4	8.7	4.3

In Table 45 it is shown that at the end of 26 weeks the Beltsville Small-type White turkeys averaged 12.5 lb., both sexes, and the feed consumption averaged 54.6 lb. per bird. The figures in the second column from the right show how the number of pounds of feed consumed per pound gain in live weight for each successive 2-week period increased until it reached 7 lb. during the twenty-first- and twenty-second-week period, after which it decreased somewhat. The figures in the right-hand column show that as the turkeys increased in age, the number of pounds of feed per pound gain in live weight steadily increased until it reached 4.4 lb. at the end of the twenty-sixth week.

TABLE 45. AVERAGE WEIGHT PER BIRD AT END OF EACH 2-WEEK PERIOD, POUNDS FEED CONSUMED PER BIRD, AND POUNDS FEED CONSUMED PER POUND GAIN IN LIVE WEIGHT FOR DIFFERENT PERIODS IN BELTSVILLE SMALL-TYPE WHITE TURKEYS

(M. I. Darrow and C. L. Morgan, South Carolina Experiment Station, 1944)

Period, weeks	Average weight per bird, at end of period, both sexes	Pounds feed consumed per bird per 2-week period	Pounds feed consumed per bird to end of period	Pounds feed consumed per pound gain in live weight per 2-week period	Pounds feed consumed per pound gain in live weight to end of period
1–2	0.3	0.6	0.6	3.3	3.3
3–4	0.7	1.1	1.7	2.7	2.9
5–6	1.4	1.7	3.4	2.4	2.7
7–8	2.2	2.5	5.9	3.1	2.8
9–10	3.3	2.5	8.4	2.3	2.6
11–12	4.4	4.1	12.5	3.7	2.9
13–14	5.7	4.6	17.1	3.6	3.1
15–16	6.9	5.1	22.2	4.3	3.3
17–18	8.1	6.2	28.4	5.2	3.6
19–20	9.2	5.4	33.8	4.9	3.7
21–22	10.1	6.3	40.1	7.0	4.0
23–24	11.2	7.2	47.3	6.6	4.2
25–26	12.5	7.3	54.6	5.6	4.4

If you have a flock of Broad-breasted Bronze, compare the results you secure with the data in Table 44, and if you have a flock of Beltsville Small-type Whites compare your results with those given in Table 45. You may be able to get better results than those given here. Various flocks of the same variety of turkeys often differ somewhat in inherent rate of growth and ability to put on flesh, especially over the breast and on the drumstick. The kind of diet fed and methods of management affect the results secured with any flock.

If you have a flock of Standardbred Bronze you should secure results approaching those given in Table 44 for Broad-breasted

Bronze. If you have a flock of White Hollands, Blacks, or any other variety you should secure results somewhere between those given here for Broad-breasted Bronze and Beltsville Small-type Whites, depending upon the average body size of your birds, the inherent rate of growth of your strain, the kind of diet fed, and methods of management employed in brooding and rearing.

Your principal objective in raising turkeys should be to produce each pound of gain in live weight on the fewest possible pounds of feed and have your turkeys in prime market condition in the shortest possible time.

6. Making Use of Turkey Manure

At the Agricultural Research Center at Beltsville, Md., it has been estimated that medium-sized breeding hens produce approximately 2.4 lb. of fresh manure per week or about 1 lb. of fresh manure per pound of feed consumed. Assuming that poults during the growing season produce manure at the same rate, the approximate amount of fresh manure produced per bird would vary from about 50 lb. by Beltsville Small-type Whites up to 26 weeks to about 90 lb. by Broad-breasted Bronze up to 30 weeks. It is quite apparent, therefore, that a flock of 1,000 or more poults produces a considerable amount of manure that should be used as fertilizer as efficiently as possible.

The approximate composition of fresh poultry manure is as follows: water, 75 per cent; nitrogen, 1.05 per cent; phosphoric acid, 0.82 per cent; and potash, 0.51 per cent. However, poultry manure that is allowed to accumulate decomposes very rapidly, especially in warm weather. In hot weather about 73 per cent of the nitrogen content is lost and much of the organic matter, although there is practically no loss of potash and phosphoric acid except when the manure is rained upon.

In order to preserve the fertilizing value of fresh manure, especially in warm weather, add at least 100 lb. or, better still, 400 lb. of superphosphate per ton of manure to prevent the escape of ammonia. This tends to retain the nitrogen content of the manure. Hydrated lime is not so efficient as superphosphate in preserving the nitrogen content of fresh manure but does have the very desirable effect of eliminating objectionable odors and tends to keep flies away. Hydrated lime has a bactericidal effect on certain disease-producing organisms, including pullorum, paratyphoid, fowl cholera, and fowl typhoid. Add 100 lb. of hydrated lime per ton of fresh manure if the lime is thoroughly mixed with the manure or 200 lb. if the lime is merely sprinkled on top of the manure. To help reduce the fly menace when turkeys are reared on sun porches, sprinkle a little hydrated lime over the manure every few days.

Artificially drying manure has been done to some extent for selling to florists and gardeners. In most cases, however, the costs of drying are apt to be quite high, largely because the moisture content must be reduced from about 75 to about 10 per cent. Moreover, since high temperatures are employed in the drying process, a considerable amount of nitrogen is lost.

Fresh poultry manure or manure that has been dried in covered sheds, especially if treated with superphosphate or hydrated lime, is suitable as a fertilizer for lawns, flowers, fruit trees, and field and garden crops. Do not add it to land that will be used as range for turkeys within 2 years. Spreading the manure on the land in the fall and winter months is preferable. When added in the spring or after plants have started to grow, do not allow the manure to come in direct contact with the plants.

SUMMARY

1. The cereal-grain portion of diets for turkeys of all ages must be properly balanced with certain proteins, minerals, and vitamins.
2. Keep in mind that the method of processing certain plant and animal protein supplements may affect their nutritive value.
3. Monthly feed consumption of breeders varies from about 18 lb. per bird in Broad-breasted Bronze to about 12 lb. per bird in the Beltsville Small-type Whites.
4. Start feeding breeding stock their egg-producing diet at least 1 month before you want them to start laying.
5. Use mash hoppers that reduce feed wastage and prevent birds from contaminating feed.
6. The breeder diet should contain about 16.5 per cent protein of good quality.
7. Artificially light the females about 1 month before eggs are wanted and start lighting the males about 1 month earlier, depending on the section of the country in which you are located.
8. Feed poults diets containing about 25 per cent protein during the first 8 weeks and then from about 24 to 13 per cent as the poults develop; according to the protein content of the mash, the poults reduce their protein intake by consuming more scratch grain in proportion to mash as they increase in age.
9. A variety of three or more cereal grains is better than a single cereal.

10. Turkey poults have very poor vision during about the first week, so that time and patience are required to teach them to eat and drink.

11. Provide plenty of hoppers and waterers and place them on wire platforms.

12. Use hoppers and water containers that prevent poults from contaminating the feed and water.

13. Provide beak cleaners, either on the hoppers or in other convenient places.

14. The average amount of feed consumed up to marketing time varies from about 85 lb. per bird in Broad-breasted Bronze to about 55 lb. per bird in Beltsville Small-type Whites.

15. On the average, Broad-breasted Bronze poults weighing 20 lb. at 28 weeks will have consumed about 4.3 lb. of feed per pound gain in weight; Beltsville Small-type Whites weighing 12.5 lb. at 26 weeks will have consumed about 4.4 lb. of feed per pound of gain in weight.

6. Controlling Parasites and Diseases of Turkeys

LOSSES from mortality and other causes result in complete failures for far too many turkey raisers each year. As a matter of fact, most turkey raisers do not appreciate what mortality in their flock costs them. If every turkey raiser fully appreciated the high cost of mortality, much more attention would be given to preventive measures because most of the losses are avoidable if proper precautions are taken. Many diseases are filth-borne and can usually be prevented from causing serious losses by adopting sanitation in houses and yards and by keeping the turkeys separated entirely from other birds. This chapter is devoted to the more important diseases affecting turkeys, together with a discussion of practical ways of reducing losses from mortality and other causes. The major activities included are

1. Estimating the Cost of Mortality.
2. Controlling Lice and Mites.
3. Controlling Worms.
4. Controlling Protozoan Diseases.
5. Controlling Bacterial and Virus Diseases.
6. Controlling Fungus Diseases.
7. Controlling Miscellaneous Diseases.
8. Keeping Losses from Parasites and Diseases at a Minimum.

1. Estimating the Cost of Mortality

Most flock owners do not keep accurate records of the age of birds that die so that they cannot determine how much money they lost on feed, labor, and other items of expense on birds from which they receive no return. They know how many breeders they had at the beginning and at the end of the breeding season and how many poults were started and how many were marketed and then, in all too many cases, they wonder why they did not make more money. Although many turkey raisers keep records of the feed consumed by the breeding stock and growing flock and count the money received from breeders and poults sold, they usually do not know how much money they have lost as the result of disease and parasites.

In many cases the importance of controlling mortality is not appreciated until a disease of epidemic proportions strikes the flock. Rarely do turkey raisers count the cost of the dread blackhead disease. In many other cases losses of an indirect nature are not appreciated, as in the case of an outbreak of pox which may cause little or no mortality but retards growth and reduces efficiency in the utilization of feed. Neglect in having the breeding flock properly tested for pullorum disease and removing the reactors may result in high mortality among the poults. These are but a few examples pointing to the necessity of doing everything possible to prevent disease and parasites from gaining a foothold in your flock.

If you are a turkey breeder, you know that every breeding female and, especially, male that dies costs you a considerable amount of money. Breeding stock represents the pick of the entire flock raised after very careful selection at marketing time or earlier. Every breeder, therefore, should be worth much more than the market price received for the rest of the flock. Do everything possible to reduce losses from mortality in your breeding stock, not only because of the value of the individual birds but because each male that dies must be replaced at considerable expense and each female that dies means fewer eggs and fewer poults from the flock as a whole. The data in Table 46 show losses sustained in breeding flocks according to the region of the country.

Table 46. Mortality Percentages in Breeding Flocks

Region*	1937	1938	1939	1940	1941	1942	1943
North Atlantic	11	11	10	9	7	8	8
East North Central	11	12	10	10	10	11	12
West North Central	11	12	10	10	10	10	13
South Atlantic	12	13	12	11	10	11	13
South Central	18	14	17	13	13	16	14
Western	5	6	5	5	8	7	8
United States	11.8	10.9	10.4	9.4	10.1	11.1	11.8

* The states in each region are as follows: North Atlantic—New England and New York, New Jersey, and Pennsylvania; East North Central—Ohio, Indiana, Michigan, Illinois, Wisconsin; West North Central—Minnesota, Iowa, South Dakota, Missouri, Nebraska, North Dakota, Kansas; South Atlantic—Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Florida, Georgia; South Central—Kentucky, Tennessee, Mississippi, Alabama, Arkansas, Louisiana, Oklahoma, Texas; Western—Montana, Wyoming, Idaho, Colorado, New Mexico, Arizona, Washington, Oregon, Utah, Nevada, California.

The data in Table 46 show that from 1937 to 1940 there was a progressive decrease in mortality but that during the next 3 years there was a progressive increase in mortality. Since in 1941, 1942, and 1943 there were over 6.5 million birds on hand on January 1 each year, it is realized that a 10 per cent loss means over 650,000 breeders lost each breeding season. If these breeders are valued at a nominal price of $5 per bird, that means an annual loss of $3,250,000.

Table 47. Mortality Percentages in Growing Flocks

Region	1937	1938	1939	1940	1941	1942	1943
North Atlantic	19	16	17	19	17	19	23
East North Central	22	21	20	19	21	23	23
West North Central	24	23	23	29*	24	28	29
South Atlantic	32	31	35	28	27	31	38
South Central	36	38	38	31	45	43	44
Western	21	20	19	20	22	21	21
United States	27.0	26.3	26.0	25.9	27.8	28.8	29.7

* In 1940, losses in the West North Central states were greater than usual due to a severe November storm.

The data in Table 47 show that from 1937 to 1940 there was a progressive decrease in poult mortality, after which it increased each succeeding year, probably due to some extent to the relative scarcity of certain important feedstuffs during the Second World War. Since during 1941, 1942, and 1943 there were over 33 million turkeys raised each year and since over 25 per cent were lost from mortality and other causes, it is apparent that over 44 million poults were started each year and about 11 million were lost due to mortality and other causes. Most of the mortality occurs during the early brooding season, so that if a nominal price of $1 per bird lost is charged to mortality and other causes, the total loss amounted to approximately $11,000,000 annually.

The data in Table 48 show that, within any state, poult mortality among flocks may vary from less than 10 per cent to over 50 per cent. In the six states mentioned in Table 48 about 12,402,600 poults were started in 1942 but losses from mortality and other causes were approximately 2,662,600. The important point to note, however, is that in each state there was a great difference between the flock having the lowest mortality and the flock having the highest mortality.

The fact that some turkey raisers are able to raise flocks of poults with less than 10 per cent mortality should be a source of encouragement to all other flock owners. In most flocks, especially those raised on range, it is possible to reduce losses from mortality considerably by putting into effect certain management practices that reduce the hazards of disease. The latter part of this chapter shows how this can be accomplished.

TABLE 48. MORTALITY PERCENTAGES AMONG REPRESENTATIVE FLOCKS OF POULTS AND ESTIMATED TOTAL POULT MORTALITY IN SIX STATES IN 1942
(J. J. Scanlan, Farm Credit Administration, U. S. Department of Agriculture, 1944)

State	Flock with lowest percentage of mortality	Flock with highest percentage of mortality	Average percentage of mortality all flocks	Approximate number poults that died
California...	7.1	40.6	21.3	847,500
Colorado....	3.1	33.5	17.8	192,200
Kansas	6.9	67.2	24.8	351,000
Minnesota...	7.5	53.3	20.4	821,600
Montana....	8.1	47.3	17.8	59,700
Utah.......	6.1	64.0	25.1	390,600
Average...	6.5	51.0	21.5	2,662,600

Poults hatched very late in the season usually do not grow so fast as poults hatched early in the season and mortality is apt to be much higher, as shown in Fig. 122.

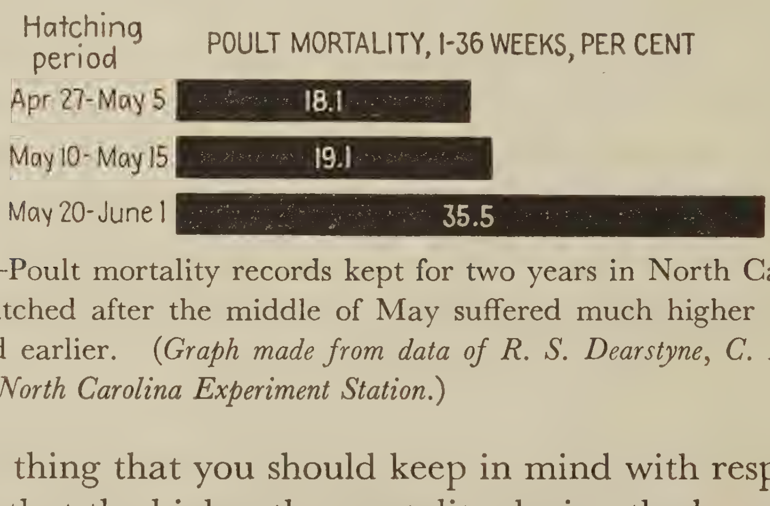


FIG. 122.—Poult mortality records kept for two years in North Carolina showed that poults hatched after the middle of May suffered much higher mortality than poults hatched earlier. (*Graph made from data of R. S. Dearstyne, C. H. Bostian, and W. B. Nesbit, North Carolina Experiment Station.*)

Another thing that you should keep in mind with respect to poult mortality is that the higher the mortality during the brooding period, usually the higher the mortality on range. This is shown quite clearly in Fig. 123 in the case of Utah turkey producers in 1942. This indicates how important it is for you to keep your brooding mortality at a minimum.

Most of the poult mortality occurs during the first 4 weeks, as shown in Fig. 124. During the next 8 weeks the mortality is usually much higher than during the rest of the growing period. You realize, of course, that early poult mortality is relatively not so expensive as late poult mortality, but you must always keep in mind that, because of the relatively high cost of poults, mortality at any period is costly.

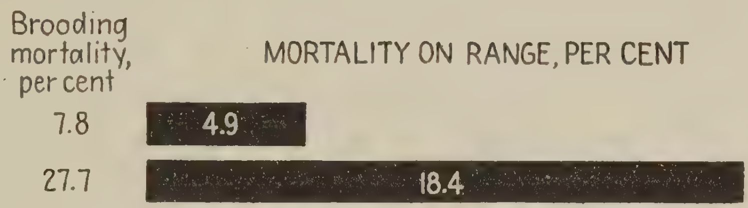


FIG. 123.—In Utah it was found that poult mortality during the brooding period was approximately 3½ times as much in one group of 16 flocks as in another group of 17 other flocks and that the group of 16 flocks had a mortality on range of approximately 3¾ times as much as the group of 17 flocks. Thus high brooding mortality was followed by high range mortality. (*Graph from data of D. A. Broadbent, W. P. Thomas, and G. T. Blanch, Utah Experiment Station.*)

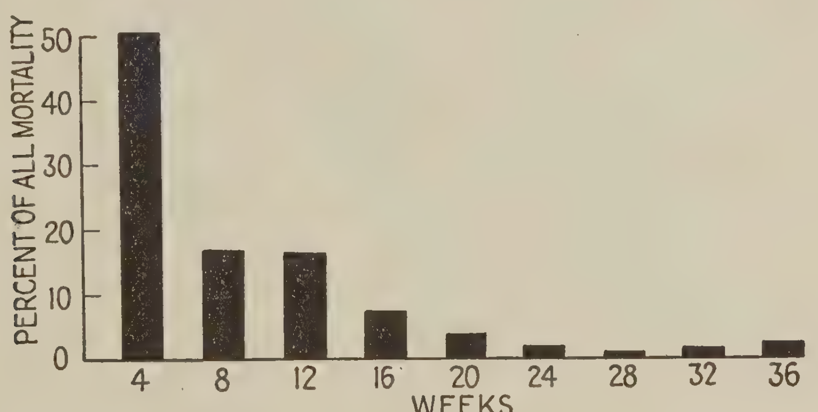


FIG. 124.—In North Carolina it was found that poult mortality during the first 4 weeks amounted to about 50 per cent of the total mortality that occurred up to the thirty-seventh week. Mortality during each of the next two 4-week periods amounted to about 18 per cent of the total mortality. In these flocks about 86 per cent of the total rearing mortality occurred by the thirteenth week. (*R. S. Dearstyne, C. H. Bostian, and W. B. Nesbit, North Carolina Experiment Station.*)

2. Controlling Lice and Mites

Lice. Turkeys that are allowed to mingle with chickens and poults that are hatched by chicken or turkey hens are much more apt to be lousy than turkeys kept entirely separate from other poultry and poults reared entirely separate from adult turkeys. Lice common to turkeys include the large turkey louse (*Goniodes meleagridis*) and the slender turkey louse (*Lipeurus gallipavonis*). Poults hatched under chicken hens and brooded by them may become infested with one or more species of chicken lice.

Lice do not suck blood but feed on portions of the feathers and on scales from the skin. They spend practically all their time on the birds, and poults badly infested with lice become droopy, have ruffled feathers, and are stunted in growth. If you have reason to suspect that your poults are infested, examine the base of the feathers, especially around the vent.

Probably the simplest way of ridding poults of lice is to apply sodium fluoride by the "pinch method." Put a small pinch at the base of the feathers on the breast, on each thigh, below the vent, on each side of the back, on the head, and on the underside of each outspread wing. Do not treat poults before they are 1 week old. Since louse eggs hatch in about 1 week, another treatment is necessary about 10 days after the first one in the case of a badly infested flock of poults. If you must hatch your poults under hens, treat the hens when you set them if they are lousy and again in about 10 days. Sodium fluoride is irritating to the nose and throat, so wear a wet cloth over the nose and mouth if there is any danger of the dust blowing in your face. *Sodium fluoride is poisonous to humans* so that great care should be exercised in storing it.

Breeding stock may also be treated by painting the upper sides of the roosts with 40 per cent nicotine sulphate about half an hour before the birds go to roost.

A few dabs of mercurial ointment may be applied to different parts of the bird's body to rid it of lice, but this substance should not be used in treating hens sitting on hatching eggs or the embryos may be killed.

Mites. Mites are bloodsucking parasites that live in the cracks and crevices around the roosting quarters and attack the birds at night. Mites do not trouble turkeys nearly as much as they do chickens. The presence of mites can be detected by areas around the roosting quarters covered with mite eggs resembling a sprinkling of gray pepper. The most common mite affecting turkeys is the red mite (*Dermanysus gallinae*), which when full of blood is red in color. Paint or spray the sides and bottoms of roosts and supports with an anthracene oil, a coal-tar disinfectant, or used crankcase oil.

The scaly-leg mite (*Cnemidocoptes mutans*) occasionally causes trouble in turkeys by burrowing under the scales of the shanks. Dry the shanks thoroughly and then dip them in a mixture of one part kerosene and two parts raw linseed oil.

3. Controlling Worms

Worms sometimes cause serious losses among flocks of poults before turkey raisers are aware of the cause. Most worms infest the digestive tract but some infest the respiratory tract and if a serious infestation occurs, the poults become weak, have ruffled feathers, and become dumpy. There are several different species of worms but only a few are of serious concern to the turkey raiser. Most of those found in turkeys depend upon an intermediate host for the early stages of their development. These intermediate hosts, such as flies,

FIG. 125.—Turkey in advanced stage of infestation with *Capillaria contorta.* (*M. W. Emmel, Florida Agricultural College.*)

earthworms, snails, and slugs, devour the worm eggs deposited in the droppings and when these intermediate hosts are devoured by turkeys they become infested. If you suspect worm infestation in your flock, kill one of the worst specimens and examine the interior of the intestinal tract. Do not be alarmed if there are a few worms present but if the bird is seriously infested, consult a veterinarian or the proper authorities at your state college of agriculture.

Capillaria Worms. Three species of capillaria worms are known to infest turkeys. *Capillaria annulata* and *Capillaria contorta* infest the esophagus and crop and *Capillaria caudiriflata* the small intestine. These worms are long and threadlike. Five per cent commercial flowers of sulphur fed in the mash for about 4 days is helpful against infestation of *Capillaria contorta.*

Caecum or Caecal Worm. These worms (*Heterakis gallinea*), which infest the caeca or blind pouches of the intestinal tract of the turkey, are of economic importance because they serve as carriers of the blackhead organism described later.

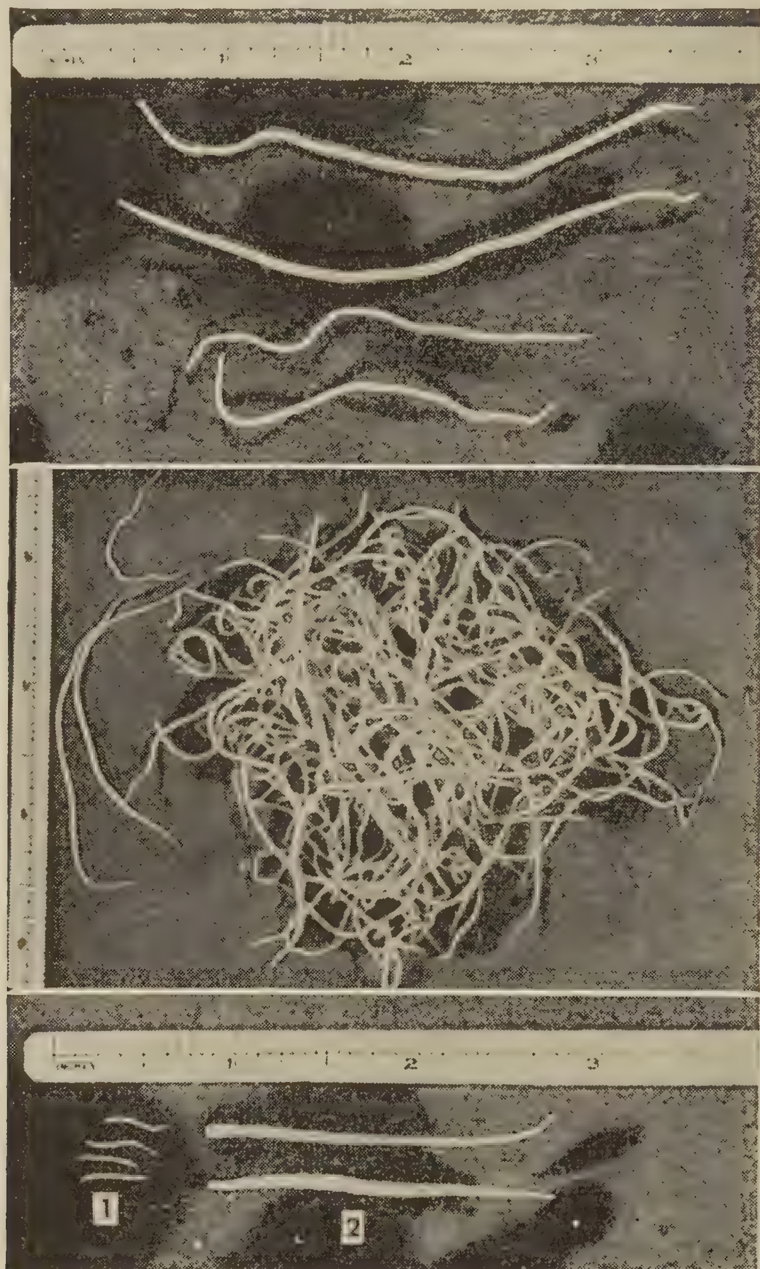


FIG. 126.—Top, common roundworms (*Ascaridia lineata*) that sometimes infest the small intestines of turkeys. Two females above and two males below. Center, 121 roundworms found in the small intestine of a three-month-old poult. Bottom, pinworms (1) and tapeworms (2), showing their segmented bodies. (*E. M. Dickinson, Oregon Experiment Station.*)

Gapeworms. These roundworms (*Syngamus trachea*) infest the windpipe of turkeys, sometimes causing death by suffocation. In cases of serious infestation the mucous membrane of the windpipe or trachea is irritated and inflamed and the bird coughs violently. If turkeys and chickens are allowed to intermingle, the chickens may contract gapeworm infestation from turkevs and suffer more severely than turkeys.

Roundworms. These intestinal parasites (*Ascaridia lineata*) are not so serious a menace to turkeys as to chickens. If your flock is moved from the brooder house to contaminated soil, feed 4 lb. of tobacco dust, containing at least 2 per cent nicotine, in each 100 lb. of mash. Clean range and frequent rotation of the flock, feeders, and waterers is the best safeguard, however, against roundworm infestation.

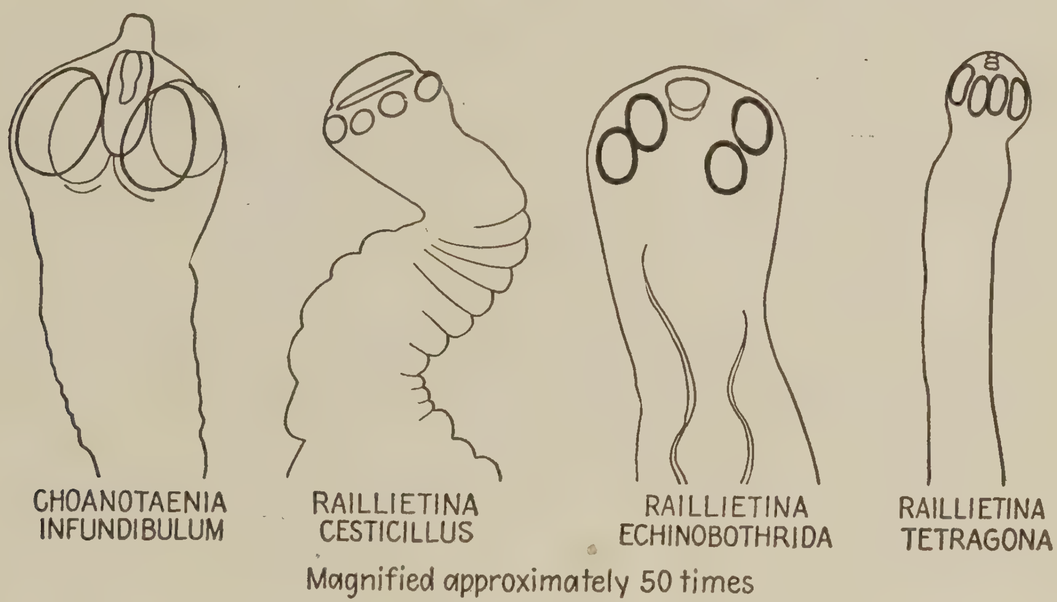


FIG. 127.—Heads of four of seven varieties of tapeworms found in turkeys. (*George H. Lee Research Laboratory.*)

Tapeworms. These flattened intestinal worms embrace several species, each species for the most part infesting a particular section of the intestinal tract. They vary greatly in size but each tapeworm consists of a head, neck, and a variable number of segments. The head or scolex of the tapeworm attaches itself to the lining of the intestinal tract and from the posterior portion new segments are continually being formed. In a completely formed tapeworm, the end segments are egg sacs and are deposited with the droppings.

Since the head of the tapeworm tends to remain firmly attached to the lining of the intestinal tract, the successful treatment of heavily infested birds is extremely difficult. As in the case of other worms that infest the intestinal tract of turkeys, practicing sanitation in raising turkeys to prevent worms from getting a foothold is far more important than trying to cure wormy birds. Up to the present no drug has been found to be very satisfactory in treating birds suffering from a severe infestation of tapeworms.

Using Worm-control Measures. Poults reared on sun porches rarely, if ever, become seriously infested with intestinal worms of any kind. This should convince raisers that a reasonable degree of sanitation will keep worm infestation under control. If you rear your poults on range, keep your poults confined to a sun porch for about the first 8 weeks and then rotate your flock regularly on clean range as outlined in Chap. 4. Keep the litter in the brooder house dry, especially around the water containers. Be sure that the poults cannot contaminate their feed and water.

Since the droppings deposited by worm-infested birds are the source from which the intermediate hosts become infested, it is very important to remove the droppings from the brooder house frequently and keep the turkeys away from the droppings under the roosts when the poults are on range. Move the feeders and water containers frequently, as outlined in Chap. 4. Be sure there are no puddles or other places holding stale water. Under no circumstances should turkeys be allowed to mingle with chickens of any age and, in addition, poults should not be allowed to mingle with adult turkeys.

4. Controlling Protozoan Diseases

Protozoa are tiny one-celled creatures representing the smallest kind of animals in existence. Certain kinds of protozoa gain access to the body of the turkey and produce a diseased condition of the parts affected. Once a flock becomes severely infected, mortality is apt to be very high. Everything possible should be done, therefore, to prevent these minute organisms from getting a foothold in the flock.

Blackhead. Blackhead is one of the most serious diseases with which turkey raisers have to contend. During the past 50 years it has taken a toll of several million birds. In the early part of the twentieth century blackhead became so prevalent in the Eastern section of the United States that many turkey raisers became discouraged and quit the business.

The data in Fig. 128, for New York, Pennsylvania, Ohio, and Indiana, show the great extent to which breeding stock on hand at the beginning of the breeding season in 1920 had been reduced from breeding stock on hand at the beginning of the breeding season in 1910. The decline of the turkey industry in this section of the country during the period mentioned was due largely to blackhead, which was prevalent because most turkey raisers had not learned of the importance of clean range and the necessity of rotating the flock over the range during the growing season.

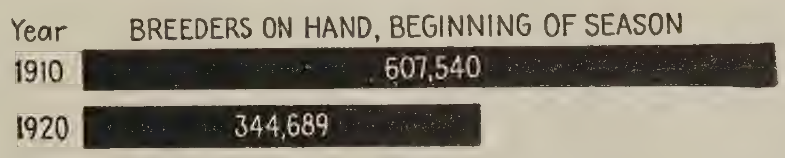


FIG. 128.—In New York, Pennsylvania, Ohio, and Indiana the number of breeders on hand at the beginning of the breeding season in 1920 was much less than in 1910. The ravages of blackhead among flocks over a period of years resulted in a decrease in the turkey enterprise.

In most sections of the western part of the country the turkey industry continued to expand during the early part of the twentieth century, as indicated in Fig. 129, which gives the numbers of breeding stock on hand at the beginning of the breeding season in 1920 as compared with 1910 in California, Minnesota, Oklahoma, and Texas.

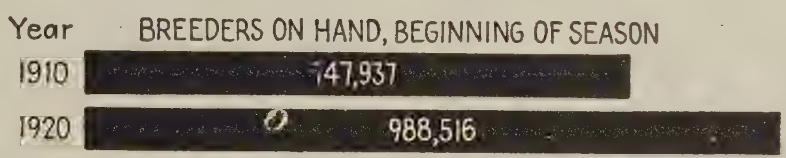


FIG. 129.—In California, Minnesota, Oklahoma, and Texas the turkey industry expanded considerably between 1910 and 1920, as indicated by the increase in breeding stock on hand at the beginning of the breeding season in 1920 as compared with 1910.

In this section of the country relatively more land was available on each farm for raising turkeys and the turkey ranges had not become so contaminated with blackhead organisms as in the eastern section of the country.

Symptoms. The term "blackhead" is really a misnomer because a darkened head resulting from infection is not a characteristic of this disease only. The proper name for this disease is "enterohepatitis." The characteristic symptoms include drowsiness, weakness, ruffled feathers, head lowered, wings and tail drooping, and a sulphur-colored diarrhea, especially in older birds. If an outbreak occurs, losses are usually heaviest during the first 12 weeks of life. In many cases over 50 per cent of the flock is lost. Older poults are often stricken with the disease, however, and adult birds may suffer heavy mortality if kept on contaminated soil.

Organs Affected. The organs principally affected are the caeca and liver. The disease develops first in the caecum, which provides an excellent medium for the development of the organism. In an advanced stage of infection one or both caeca may be greatly enlarged,

Fig. 130.—Top left, liver of turkey that died of blackhead; note the degenerated tissue covering most of the surface of each lobe, the affected circular areas being depressed. (*A. J. Durant, University of Missouri.*) Bottom left, turkey affected with an advanced case of blackhead, indicated by sunken eye and drooping wings. (*A. J. Durant, University of Missouri.*) Right, lesions of blackhead in a turkey, the right caecum being swollen and ulcerated; left caecum is normal. (*L. D. Bushnell and M. J. Twiehaus, Kansas Experiment Station.*)

as shown in Fig. 130. The inner surface of the caecum is covered with large ulcers, varying in size from a pinhead to others that cover most of the inner surface of the organ.

From the caeca the organism is carried by the blood stream to the liver. The surface of the affected liver is usually covered with degenerated tissues, which are more or less circular in shape, are slightly depressed, and are yellowish or yellowish-green in appearance (see Fig. 130).

Causative Organism. The organism that causes blackhead is a protozoan parasite *Histomanis meleagridis.* This parasite is harbored by the common poultry caecum worm, *Heterakis gallinea*, mentioned pre-

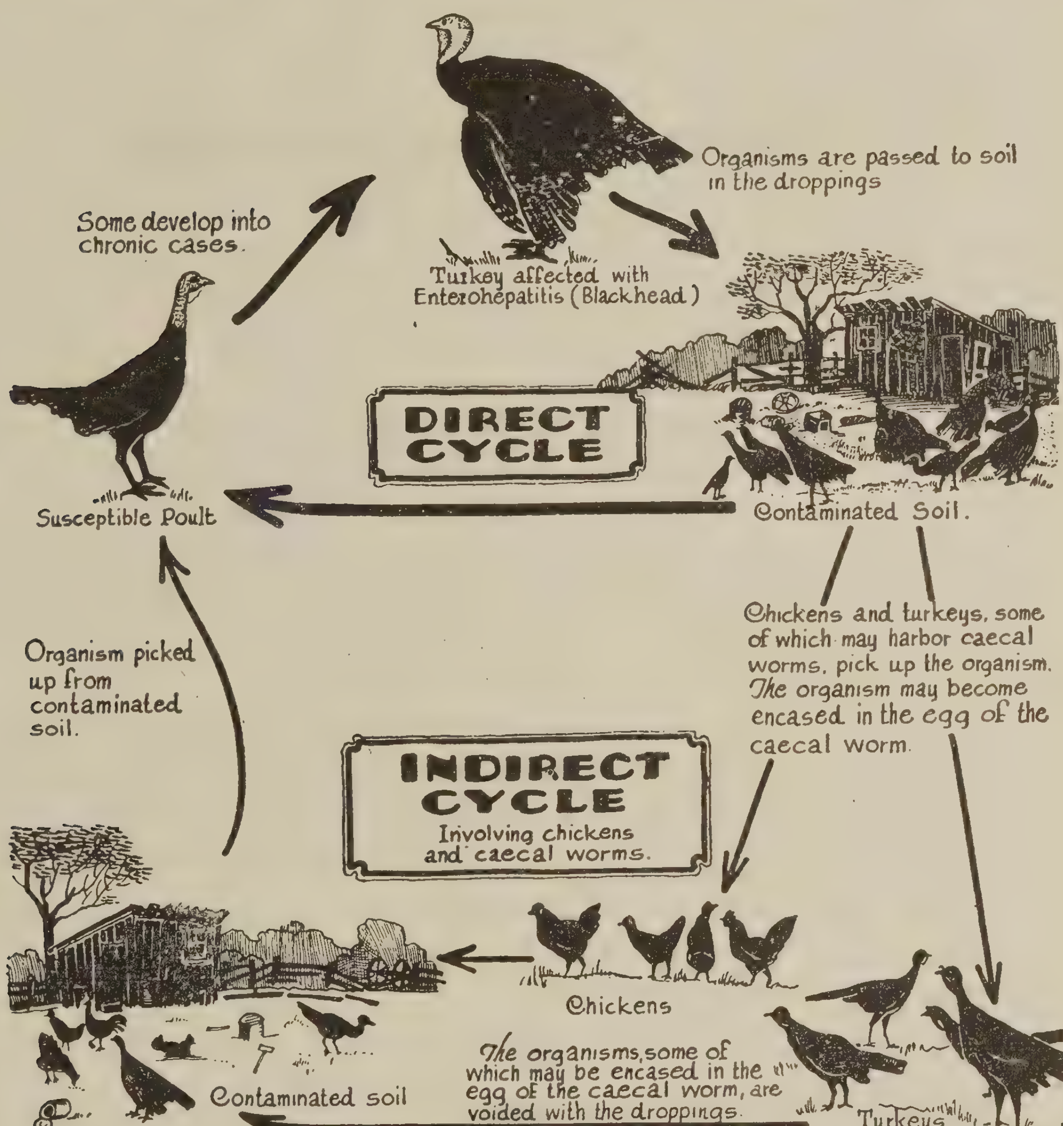


FIG. 131.—Life cycle of *Histomonas meleagridis*, the parasite causing blackhead in turkeys. (*A. R. Winter, University of Ohio.*)

viously. Although the caecum worm is often found in chickens, they rarely suffer from blackhead infection but transmit the disease through their droppings to turkeys. Healthy turkeys also contract the disease from infected turkeys if the healthy birds pick at the droppings of the diseased birds. *Histomanis meleagridis* is contained in large numbers in the droppings of infected turkeys and in the eggs of caecal worms passed out in the droppings of chickens. That is why it is so important to keep turkeys on clean range and entirely separated from chickens of all ages (see Fig. 131).

Prevention. A careful study of Fig. 132 will convince anyone that proper sanitation is the key to blackhead control. Blackhead is a filth-borne disease. Rearing turkeys in sun porches is probably the simplest way of controlling blackhead. If you cannot rear your

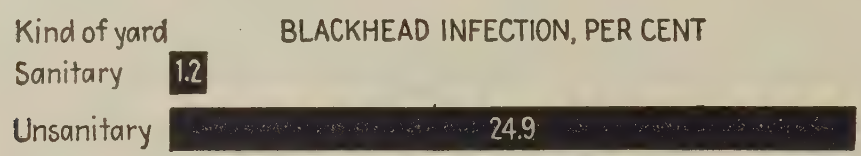


Fig. 132.—Showing the difference in average annual blackhead infection from 1931 to 1936, inclusive, between poults reared each year in sanitary yards, covered with hardware cloth, and poults raised in an unsanitary yard. (*L. Van Es and J. F. Olney, Nebraska Experiment Station.*)

turkeys in sun porches, which would probably be the case if very large flocks are raised annually, adopt the following program:

1. Hatch your poults in incubators or purchase poults from a hatchery.
2. Keep the brooder-house floor thoroughly clean, using a hardware-cloth floor if necessary, and use feeding and watering equipment that will prevent the turkeys from contaminating the feed and water.
3. Use a sun porch attached to the brooder house for the first 12 weeks.
4. Use clean range that has not been occupied by other poultry for 2 years and rotate the flocks to different yards or areas as outlined in Chap. 4, being sure to keep the birds away from their droppings as much as possible. Avoid drainage from chicken yards to turkey yards.
5. Avoid using fields for range on which chicken or turkey manure has been spread within the past 2 years.
6. While the birds are on range, move the feeding and watering equipment frequently, as outlined in Chap. 4.
7. Keep turkeys entirely separated from chickens of all ages and keep poults entirely separated from adult turkeys.
8. Do not have a person who attends chickens also attend turkeys.
9. If you have had an outbreak of blackhead in your flock, do not raise any more turkeys on that land for at least 2 years after the last bird of the diseased flock was removed.
10. If you buy new stock, keep it quarantined for at least 3 weeks before putting it with your flock.

The data in Fig. 132 show that it is possible to keep losses from blackhead at a minimum if proper sanitary precautions are followed.

Treatment in Case of Outbreak. There are no remedies for blackhead, insofar as is known. If blackhead appears in your flocks, carry out the following program:

1. Go over the entire flock carefully and isolate sick poults in a pen with a wire floor.
2. Move the healthy birds immediately to a clean yard or range or put them in sun porches. Watch these birds carefully for indications of new cases of infection.

In case you are obliged to raise your turkeys on ground that is probably contaminated, either one of the following steps might be followed as a preventive measure against the caecal worm.

1. Use 4 lb. of tobacco dust, containing at least 2 per cent nicotine, per 100 lb. of mash from the time the poults are moved from the brooder house to the range.
2. Give each poult ½ gram and each adult turkey 1 gram of phenothiazine. Remember, however, that these two practices are not remedies for blackhead; they are merely intended to control caecal worm infestation.

Always keep in mind the fact that blackhead can be adequately controlled by proper sanitation.

Coccidiosis. This disease is caused by a minute protozoan organism, coccidium, of which there are two species that infect turkeys, *Eimeria meleagridis* and *Eimeria meleagrimitis.* The first species attacks the lower half of the small intestine in young poults and the caeca in adults. The second species attacks the small intestine. Symptoms indicating infection include listlessness, ruffled feathers, drooping wings, and a lightish brown diarrhea. Adult turkeys and contaminated feed and water are the chief sources of infection. The organism in the infective stage can be carried to the turkey brooder house or yard on the shoes of the attendant and can be incorporated in the feed when it is mixed on the floor.

Keep poults away from adult turkeys. Keep the feed and water in the brooder house from becoming contaminated. Keep the litter in the brooder house dry at all times. Avoid, insofar as possible, carrying the infective organisms on your shoes or mixing it with the feed. Use every sanitary precaution possible and you should have little loss from coccidiosis. Sun porches help to keep this disease in check.

Hexamitiasis. This disease is also known as "infectious catarrhal enteritis" and is caused by *Hexamita meleagridis.* In the early stages of infection poults appear nervous, have ruffled feathers and an unsteady gait, and there is a foamy watery diarrhea. They lose weight rapidly. The upper part of the intestinal tract is the seat of infection. Mortality following an outbreak usually occurs among poults within the first 7 weeks of life. Outbreaks are more liable to occur in late hatches.

Adult turkeys, quail, and partridges that have survived an outbreak serve as carriers of the disease. From a practical standpoint of controlling this disease it is most important to prevent poults from coming in contact with the droppings of adult turkeys. Strict sanitation in brooding is essential. If an outbreak occurs in one brooder

FIG. 133.—Hexamitiasis. (*W. R. Hinshaw, California Experiment Station.*)

house, it should be completely isolated from all other turkey houses and a different attendant should care for the poults.

Leucocytozoon Infection. This disease is due to a parasite, *Leucocytozoon smithi*, in the blood of turkeys and is more common in the southeastern part of the United States than elsewhere. Droopiness, loss of appetite, and a tendency to remain sitting are characteristic symptoms of this disease. Upon examination, the duodenum appears slightly inflamed. The disease rarely occurs among poults over 12 weeks of age. Three species of black flies may infect turkeys by biting them. In order to ensure complete control of these black flies, cover the windows and doors of the brooder house with cheesecloth.

Trichomoniasis. The cause of this disease is a trichomonad, *Trichomonas gallinae*, which is often present in stagnant pools, ditches, and puddles. Turkeys on range, therefore, are more liable to become infected if there are any such areas on the range. Typical symptoms include a depressed breast with the head drawn toward the body, darkened heads, and sunken sinuses. Autopsy findings reveal a chronic ulceration of the crop and sometimes the esophageal portion of the proventriculus is also involved. In other forms of the disease

FIG. 134.—Turkey suffering from trichomoniasis of the upper digestive tract; note ruffled feathers, sagging wings, and sunken breast. (*W. R. Hinshaw, California Experiment Station.*) Lower portion of picture shows lesions in the crop and proventriculus of a turkey infected with trichomoniasis. (*L. D. Bushnell and M. J. Twiehaus, Kansas Experiment Station.*)

the liver and caeca are involved. Sanitation will control the first form of the disease, keeping the turkeys off any land containing stagnant water and land that is poorly drained. If an outbreak occurs, move the birds to dry land and keep sick birds separated from the rest. The sick birds may be treated by giving them a 1 to 2,000 solution of copper sulphate for 2 or 3 days and repeating again after a few days, all natural drinking water being withheld while the copper-sulphate solution is before the birds.

The second form of the disease, where the liver and caeca are involved, can apparently be cured by fever therapy, which is accomplished by keeping the birds within an air-conditioned cabinet from 1 to 2 hr., during which time the air temperature is maintained at 104 to 106°F. and the relative humidity maintained at about 50 per cent. During treatment the body temperature rises from the normal 106.5°F. to about 111 to 112°, and three treatments are apparently adequate.

5. Controlling Bacterial and Virus Diseases

Certain bacteria, tiny organisms visible only under the microscope, give rise to a diseased condition in turkeys that sometimes causes enormous losses. Viruses are disease-producing organisms that can be seen only with the aid of an electron-microscope; some of them constitute a serious menace once they gain a foothold.

Botulism. Another name for this disease is "limberneck," caused by toxins produce by a bacterium, *Clostridium botulinum.* In dead animals, wet grain, and other decomposing materials, these bacteria produce toxins that are poisonous to birds, the neck becoming paralyzed. Every precaution should be taken, therefore, to keep turkeys away from dead animals and decomposed vegetable matter of all kinds, including stagnant pools of water. If the disease appears, move the birds to new dry ground. With the aid of a rubber tube and funnel, drain the crops of sick birds with warm water and place the birds in the shade. Large doses of mineral oil or castor oil will help to expel the toxin. Wash the hands after treating sick birds because the botulinus toxin can affect man.

Erysipelas. This disease is caused by the swine erysipelas organism, *Erysipelothrix rhusiopathiae*, although sheep rather than swine have been more frequently involved in the transmission of the disease to turkeys in this country. Infected birds become listless and the wings and tails droop but there is little or no diarrhea. A nasal catarrh and a swollen snood are common symptoms. Autopsy of dead birds reveals diffuse hemorrhagic areas in the breast muscles, nasal passages usually filled with a thick mucus, enlarged livers and spleens. No reliable treatment has yet been found. Turkeys should not be allowed to mingle with sheep and swine, since erysipelas may affect these animals.

Fowl Cholera. *Pasteurella avicida* is the causative organism of this disease, which sometimes results in severe losses in individual flocks. The monetary losses suffered by many turkey raisers are often very great because the disease is usually most prevalent among turkeys

FIG. 135.—Natural case of erysipelas. (*A. S. Rosenwald and E. M. Dickinson, Oregon Experiment Station.*)

from 6 to 8 months of age. Chickens have been shown to spread the disease in many cases, although adult turkeys may harbor the organism. Heavy losses often occur within a few days.

Characteristic symptoms include listlessness, loss of appetite, increased thirst, temperature 2 to 3° above normal, and a yellow watery diarrhea. Autopsy findings include congested breast muscles, sour odor of feed in crop, enlarged heart, and the blood vessels of the intestines usually engorged with blood.

There is no known treatment for fowl cholera. To prevent the disease from invading your flock should be your principal aim. Keep your adult turkeys and your poults away from chickens and keep your poults away from adult turkeys. It is especially important to keep your turkeys away from other fowl that have suffered from the disease. In other words, always keep your turkeys in a sanitary environment.

Fowl Pox. This disease is easily recognized in advanced stages by the appearance of scabs on the head and neck, and sometimes on the legs and feet. Mosquitoes transmit fowl pox to turkeys. Since a serious outbreak in a flock decreases feed consumption and retards growth, it is most important to do everything possible to avoid even a mild outbreak.

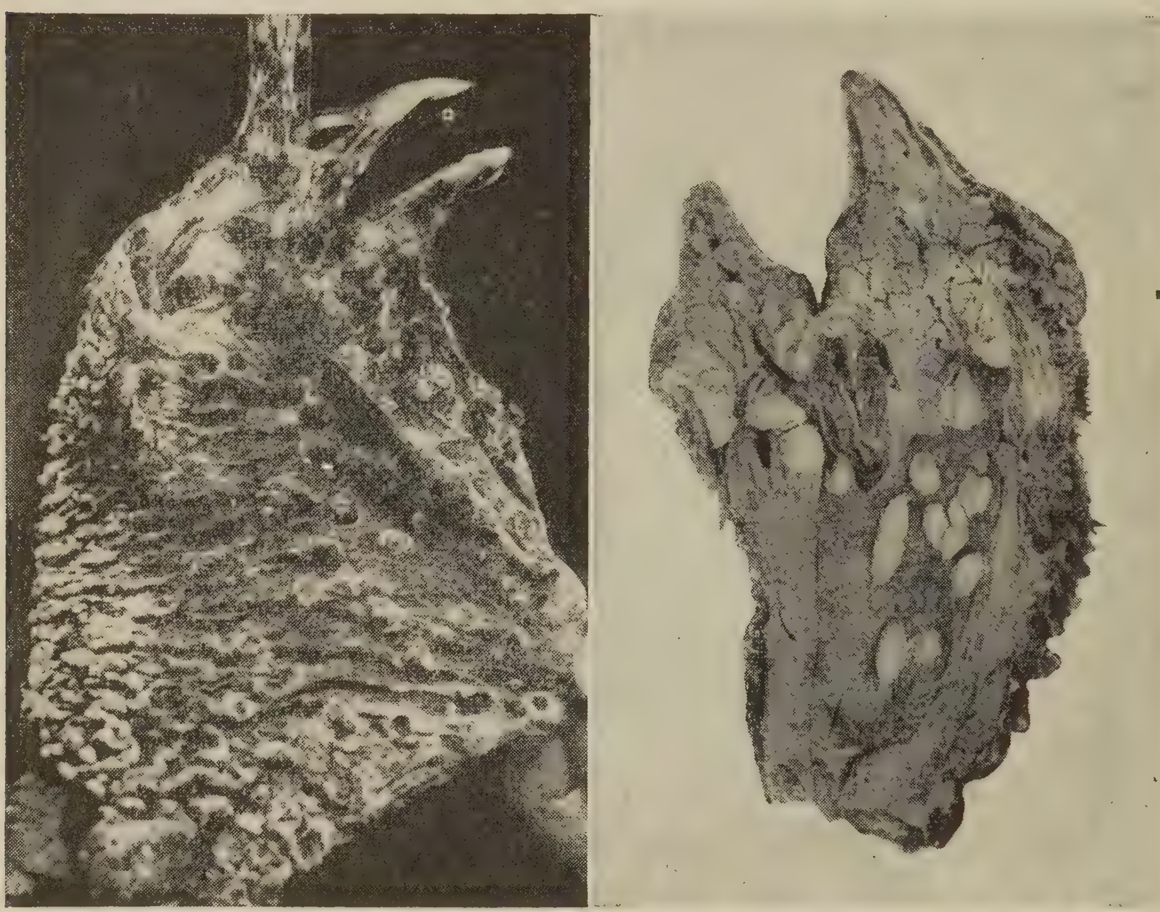


FIG. 136.—Left, fowl-pox lesions on head. Right, fowl-pox lesions in mouth and esophagus. (*W. R. Hinshaw, California Experiment Station.*)

In the earliest stages of the disease the dewlap, snood, and other parts of the head are covered with small yellowish eruptions. As the disease progresses, the corners of the mouth and eyelids become affected and yellow cankers appear on the tongue and in the esophagus. The lesions on the head parts enlarge and become covered with a dry scab. Blindness often occurs. The disease may occur in poults as early as 3 weeks of age or at any later age.

Preventing by Vaccination. The disease is most readily prevented by vaccinating the entire flock. This may not be necessary in the case of flocks where the disease has never made its appearance and where a flock is in an isolated place. The vaccine used for immunizing a flock contains live virus which is capable of producing the disease, so that it cannot be introduced safely into a flock or a community where pox has never appeared previously. However, fowl pox is so widespread in many areas that it is wise for most turkey raisers to practice annual vaccination. Besides mosquitoes, the disease is also transmitted by birds and other animals, visitors, used feed sacks, and in other ways. Flocks where fowl pox has been a source of trouble should certainly be vaccinated.

Turkeys apparently may be vaccinated at almost any age although from 8 to 12 weeks seems preferable. At any rate, vaccination should be done at least 8 weeks before marketing time because it takes from 4 to 8 weeks for the vaccination lesion to disappear completely. All young turkeys and chickens on the premises should be vaccinated at the same time. Although vaccines of chicken-pox origin produce immunity in poults that last for several months, it is wise to revaccinate all birds kept as breeders as soon as they have been selected from the rest of the flock.

To ensure complete success in vaccination, be sure to purchase the vaccine from a reliable source, be sure that the manufacturer's expiration date has not been passed, and place the vaccine in the refrigerator immediately upon arrival. Mix only as much vaccine as will be used in 3 or 4 hours and protect it from the sun, heat, and dust.

Vaccinate the birds on the upper thigh, as shown in Fig. 137. Two persons are necessary to do the job properly, one to hold the bird and the other to apply the vaccine. Spread a paper over the box or table where the birds are to be vaccinated and burn the paper after vaccinating is completed. Put the vaccine in a suitable container that will not spill the vaccine and use a knife the blade of which is fixed so that an incision about $\frac{1}{16}$ in. in depth is made in the skin. The vaccinator holds to one side the tuft of feathers that normally covers the site of vaccination on the bare skin. Dip the knife or other kind of vaccinating instrument into the vaccine and then make two or three slight incisions in the skin about $\frac{1}{2}$ to 1 in. apart. After each inoculation mix the vaccine thoroughly by using the vaccinating instrument. Be sure to use fresh, potent vaccine and be sure to make an incision each "stick." The helper should avoid getting the vaccine on his hands.

FIG. 137.—Upper, method of holding turkey for vaccinating on upper thigh. Note that the table is covered with newspapers. This aids in preventing undue spread of vaccine. Lower, a close-up, taken to show the suggested location. The long tuft of feathers that normally covered this naked area is being held back by the vaccinator's left hand. The heavy glass inkwell is a convenient holder for the vaccine. To prevent excessive dust contamination, it is covered with a piece of rubber in which is cut a small opening. (*W. R. Hinshaw, California Experiment Station.*)

Be sure that every bird is vaccinated. A small flock could be confined to a range shelter so that as each bird is vaccinated it could be released, thus reducing any chance of a bird being missed. Large flocks should be confined in a corral or other enclosure with a chute leading up to the table where the vaccinating is to be done. Every precaution, however, should be taken to prevent any unvaccinated bird from getting out of the enclosure and mixing with the vaccinated birds.

When the entire flock has been vaccinated, burn or thoroughly disinfect unused vaccine for several hours to prevent the spread of virus. Burn all papers and other materials used in connection with the vaccination work. Disinfect the instruments for several hours and then rinse them thoroughly in boiled water or keep them in boiling water for at least 10 min.

Between 8 and 12 days after being vaccinated, at least one-quarter of the flock should be examined to determine whether or not the vaccination has been successful. If every bird in this sample has one or more vaccination "takes," indicated by the presence of a scab at the site of the incisions, vaccination has been successful and the entire flock may be considered to be immune 1 month after being vaccinated. Every precaution should be taken within the month after vaccination has been completed to make sure that the disease is not introduced into the flock. If several of the birds in the sample examined do not have takes, go over the entire flock and revaccinate the nonimmunized birds with fresh vaccine.

If an outbreak of fowl pox occurs in your flock that has not been vaccinated, carry out the following steps: (1) remove from the flock all birds that have scabs; (2) vaccinate the rest of the birds as soon as possible; (3) keep the birds with scabs in warm, dry quarters; (4) separate the males or keep them from fighting if possible. Debeaking toms reduces fighting. Remove the scabs from all infected birds and treat the scab sites lightly with iodine or use an iodine ointment liberally, and if necessary wash the eyes with a saturated boric acid solution.

Infectious Sinusitis. This disease is commonly called "swell-head" and is due to a swelling of the sinuses resulting from inflammation. The sinuses become filled with a watery exudate, which turns later into a semigelatinous state. Nasal discharges can be seen on the feathers over the wing as a result of wiping to clean the nostrils. In advanced stages the swelling of the sinuses continues until in some cases the eyes are closed.

Successful treatment is possible in the early stages of the disease. Insert the needle of a hypodermic syringe through the skin into the sinus and by withdrawing the plunger of the syringe the watery exudate is removed. Use a 5- or 10-cc. syringe fitted with a 15- or

16-gauge needle 1½ in. long. Leave the needle inserted into the sinus, connect with a second syringe, and inject into the sinus 1 cc. (one-fourth of a teaspoonful) of a 4 per cent solution of silver nitrate or a 15 per cent argyrol solution. Considerable swelling results from either treatment, but after 2 or 3 days it disappears and the bird

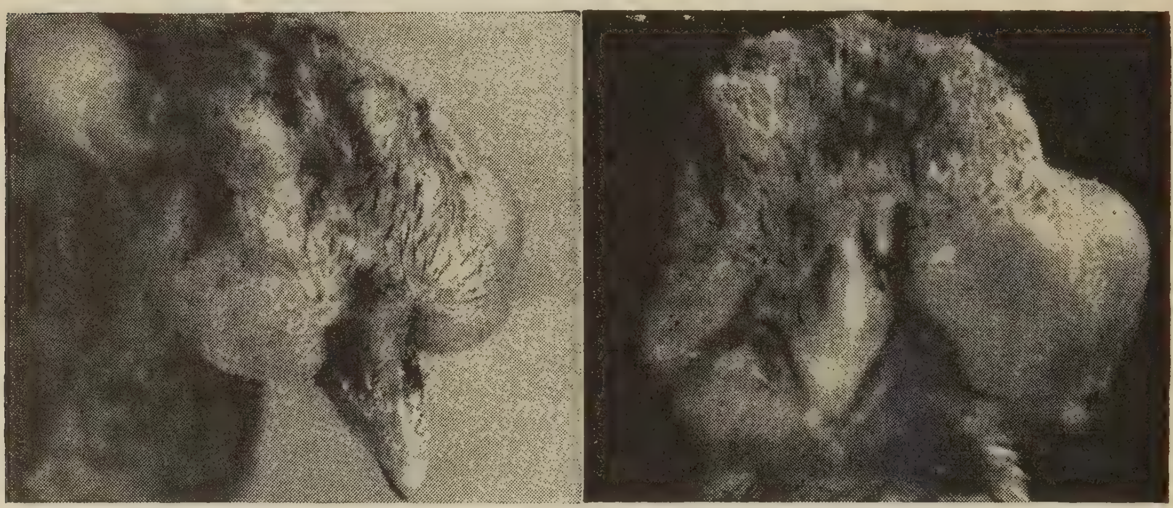


Fig. 138.—Left, an advanced case of infectious sinusitis. Right, a similar case after the exudate in one sinus was removed. (*W. R. Hinshaw, University of California.*)

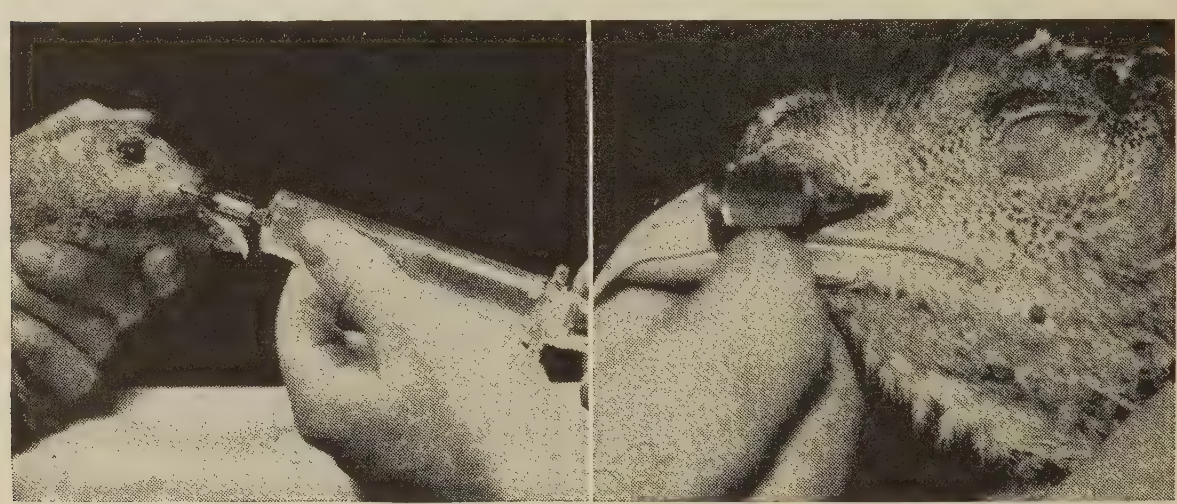


Fig. 139.—Left, showing method of inserting hypodermic needle into the sinus for withdrawing the exudate with a syringe. Right, after the exudate has been withdrawn, the needle is left in the sinus for injecting the therapeutic agent into the sinus with another syringe. (*W. R. Hinshaw, University of California.*)

usually recovers within 10 days. If the silver nitrate solution is used, wear rubber gloves to prevent the silver nitrate from burning the skin.

If the exudate has become hardened, cut out a circular section of the skin over the swollen area and press the exudate out; then insert a ball of cotton soaked in the silver nitrate or argyrol solution.

Fowl Typhoid. This disease in turkeys is frequently as highly fatal in turkey flocks as in chicken flocks and is due to the bacterial organism *Salmonella gallinarum.* The characteristic symptoms include listlessness with sagging wings and drooping tails, ruffled feathers, loss of appetite but great thirst, and a greenish to greenish-yellow diarrhea. The increased thirst is due to a marked increase in temperature, to as high as 112°F. The disease is usually of short duration but may result in mortality amounting to 25 per cent of the flock and in some cases much higher. Upon autopsy, the muscles of the breast are observed to be congested, the liver is much enlarged and mahogany-colored, the spleen is very much enlarged, and the heart and kidneys are usually enlarged. In birds that died some time previously the causative organism is more easily isolated from bone marrow than from the liver and spleen.

Turkeys that are allowed to mingle with chickens or are raised in yards or on range previously occupied by chickens are much more liable to contract fowl typhoid than turkeys raised on clean range entirely separate from chickens. If you suspect an outbreak of fowl typhoid in your flock, take the temperature of the birds and remove those whose temperature is above 108°F. and transfer the others to a new clean range after they have been given a laxative as a morning feed for 2 days, such as a mash containing 40 per cent of dried skim milk. Since the droppings are the chief source of spreading fowl typhoid, take extra precautions to prevent the turkeys from contact with droppings under the roosts and elsewhere; move the feeders and water containers every day for a few days. Be very sure that feed and water cannot be contaminated with the droppings; clean and disinfect the feeders and water containers every day. Do not keep survivors of the disease as breeders because of the possibility of transmitting the disease through the egg.

Paratyphoid Infections. As previously stated, *Salmonella gallinarum* is the causative organism of fowl typhoid. In a later section of this chapter you will learn that *Salmonella pullorum* is the causative organism of pullorum disease in turkeys. Paratyphoid infections are due to several other species of the *Salmonella* group, chief of which is *Salmonella typhimurium.*

The disease usually attacks turkeys at 3 days to 1 month of age, depending upon whether the poults became infected in the incubator or after they were placed under the brooder. Older turkeys, however, sometimes become infected.

The general symptoms in young poults include general weakness, unthriftiness, sleepiness, ruffled feathers, sagging wings, and diarrhea.

Up to 15 days of age mortality may be high. In older turkeys the symptoms include unthriftiness, loss of appetite, loss of flesh, and death after several days of sickness.

In young poults, autopsy findings reveal an inflammation of the duodenum, congestion of the liver, kidney, gall bladder, and heart muscle. In adult turkeys the liver and spleen are usually enlarged and there is a marked inflammation of the intestine.

From the standpoint of prevention and control of paratyphoid infections, the flock owner should consult the state livestock sanitary authority or poultry pathologist, because no satisfactory treatment is known and a properly trained specialist must be relied upon to determine which particular species of *Salmonella* is responsible for the outbreak in a given flock.

Pullorum Disease. This disease is identical in turkeys and in chickens, where so many poultrymen have had such unfortunate experience. It is caused by a bacterium, *Salmonella pullorum.* Infected poults show the same symptoms as infected chicks—sagging wings, drooping heads, loss of appetite, dry and wrinkled skin over the feet and shanks, and a tendency to huddle in groups. In cases lasting 2 or 3 days the down below the vent is often pasted with diarrhea. Many poults may die before showing any symptoms.

Mortality may occur within 2 days after hatching and most of the losses occur within the first 3 weeks. Mortality sometimes exceeds 50 per cent. Poults that survive an initial outbreak may become carriers and thus be a constant source of danger, or they may suffer a relapse, especially when transferred from the brooding house to the range.

In order to diagnose the disease with certainty, a bacteriological examination of dead poults is necessary. Autopsy findings include abscesses in the heart and lungs and the liver is usually congested and swollen.

Pullorum disease is communicated to poults through the medium of the egg, since the causative organism becomes localized in the ovary of a chronic carrier. Some eggs laid by a carrier may be infected, as shown in Fig. 140, and consequently some of the poults hatched may be infected. The characteristic cycle of infection is shown in Fig. 141, but the disease may be transmitted in other ways. The causative organism may be excreted with the droppings and cannibalism may increase the infection in a flock. Feed, water, and equipment contaminated with the organism serve as possible sources

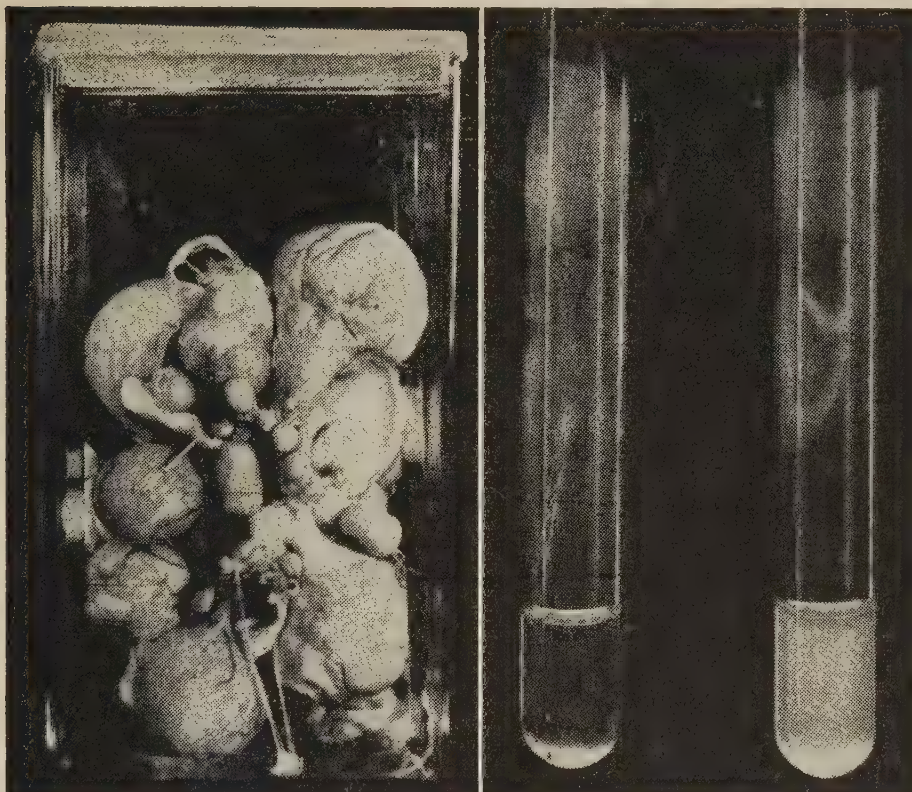


FIG. 140.—Left, ovary obtained from a reacting turkey. Numerous misshapen, cystic ova and some normal ova were present. Ovarian cultures yielded *Salmonella pullorum*. (*H. Van Roekel, Massachusetts Experiment Station.*) Right, two test tubes from two hens tested for pullorum disease. The tube on the left shows bacteria settled at the bottom of the tube, indicating a reactor. The tube on the right shows a cloudy appearance of the contents, indicating a nonreactor. (*J. R. Smyth, University of Maine.*)

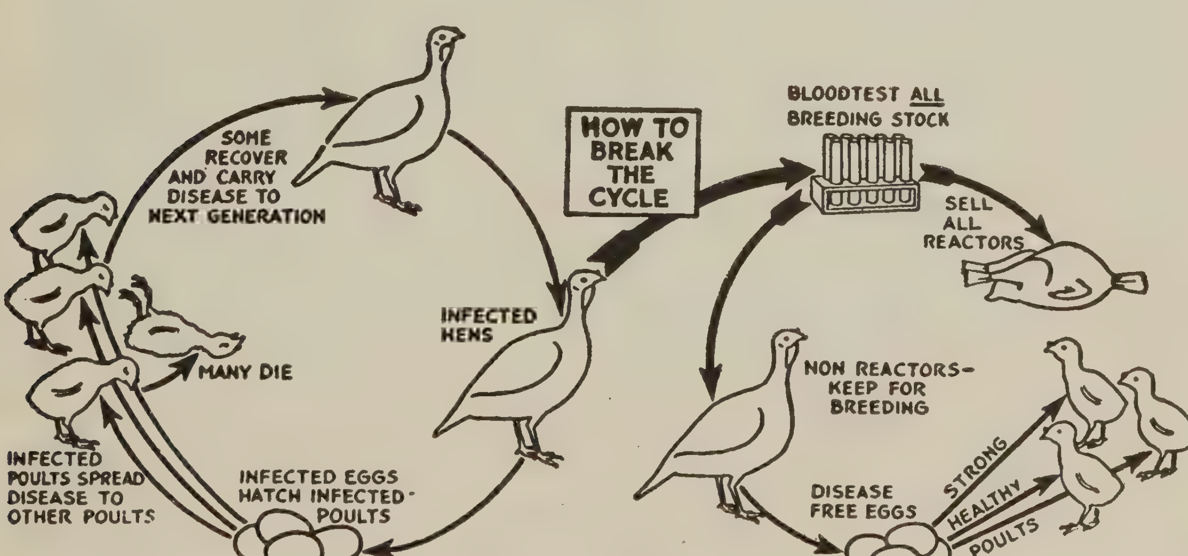


FIG. 141.—This diagram illustrates the cycle of pullorum disease. One important point this cycle does not illustrate is that outside infection can come in by hatching turkey eggs in the same machine or in the same hatchery as chicken eggs. (*Turkey World.*)

of infection. Feeding the breeding stock uncooked incubator rejects or the eating by turkeys of raw eggs in the nest may be a source of infection. A flock of breeding turkeys that becomes heavily infected will lay a sufficient number of infected eggs to contaminate a majority of the poults at hatching time; in fact, one infected poult may be responsible for the spread of the disease throughout the incubator at hatching time. Apparently pullorum disease has become quite widespread among turkey flocks of the entire country, but fortunately a method has been developed whereby the disease can be kept under control and if the proper steps are taken it can be eradicated from individual flocks.

Eradicating by Eliminating Carriers. Infected adult turkeys show no external symptoms of the disease, and it is only through the presence of the disease in poults that attention is directed to its presence in the breeding stock. The identification of infected breeders by a reliable test, their immediate removal from the breeding flocks, the cleaning and disinfection of the premises, and the disinfection of the incubators and hatching compartments constitute the minimum measures that must be undertaken to eradicate the disease from the flock. Repeated testing each season for 2 or 3 years may be necessary in some flocks in order to completely eradicate the disease.

The standard tube-agglutination test is used to detect carriers of the disease. All pullorum-testing work should be carried on under the immediate supervision of the state livestock sanitary authority or similarly qualified official in each state. A sample of blood is drawn from each bird by making a small incision in the large median wing vein. The blood samples from each flock are sent immediately to the laboratory. It is absolutely necessary that the blood samples arrive at the laboratory in good condition, care being taken to prevent spoiling in hot weather and freezing in cold weather. Upon arrival at the laboratory, the blood serum of each turkey is added to an antigen or dilute testing fluid to make a 1 to 25 dilution of the mixture. Great care must be exercised to make sure that the number on each test tube corresponds with the leg-band number of the turkey from which the blood was drawn. After the samples have been put through certain stages, the results are interpreted. A tube that remains cloudy or turbid indicates a nonreactor, whereas a tube that shows a distinct clumping of the antigen and clear liquid above the agglutinated particles indicates a reactor, as shown in Fig. 140.

Remove from the flock all birds that are carriers of pullorum disease, as indicated by the results secured from tube testing, upon completion of the test so that other birds will not become infected. Leg-band or wing-band all nonreactors to identify them as being free of the disease. Keep other poultry on the premises separate from the flock of turkeys. Chicks hatched from eggs laid by a pullorum-

FIG. 142.—Top, a satisfactory type of chute for catching turkeys in testing them for pullorum disease and vaccinating them for pox. Bottom, drawing blood for testing birds for pullorum. (*W. R. Hinshaw, California Experiment Station.*)

infected flock may spread pullorum disease to healthy poults if infected chicken eggs are incubated in the same incubator as turkey eggs from a healthy turkey flock.

Uniform Official Testing. In order that pullorum-testing work carried on in different states may be carried out on a uniform basis, the states cooperate with the Bureau of Animal Industry of the U.S. Department of Agriculture in carrying out the provisions of the National Turkey Improvement Plan. In each state participating in the plan, the pullorum-testing work is under the immediate supervision of an official state agency. Participation in the plan is entirely optional on the part of turkey raisers. Those who participate, however, must comply with the provisions of the plan. Because of lack of space in a book of this kind, only the more important features of the pullorum-testing program are discussed.

Three Official Classes Recognized. Under the provisions of the National Turkey Improvement Plan, three classes of flocks and hatcheries are recognized officially, depending upon the number of reactors found in a flock or in all flocks producing hatching eggs for a hatchery. These three classes are U.S. Pullorum-controlled, U.S. Pullorum-passed, and U.S. Pullorum-clean.

In order to qualify for any one of these officially recognized pullorum classes, the pullorum test that qualifies the flock must be made within 6 months immediately preceding the date of first sale of hatching eggs, poults, or breeding stock.

For the 1946 to 1947 and 1947 to 1948 hatching seasons, a preliminary class is recognized, known as U.S. Pullorum-tested. In this preliminary class, as in the case of the other three classes, all turkeys used as breeders must be tested when over 4 months of age under the supervision of an official state agency in the State in which the work is being carried on. During the 1946 to 1947 hatching season, a flock is recognized as U.S. Pullorum-tested if fewer than 4 per cent reactors are present in the flock and during the 1947 to 1948 hatching season, the flock must contain fewer than 3 per cent reactors to qualify as a U.S. Pullorum-tested flock. In order for a hatchery to qualify as a U.S. Pullorum-tested hatchery, all hatching eggs must be secured from U.S. Pullorum-tested flocks, except that eggs may also be secured from flocks that qualify for any of the other three classes. After the 1947 to 1948 hatching season, the U.S. Pullorum-tested class is to be discontinued.

The U.S. Pullorum-controlled class is considered as a steppingstone for the purpose of qualifying flocks and hatcheries for the two higher classes. U.S. Pullorum-controlled flocks are those that have fewer than 2 per cent reactors. A flock containing 2 or more per cent reactors on the first test may be retested at intervals of not less than 30 days until it contains fewer than 2 per cent reactors in order to qualify as a U.S. Pullorum-controlled flock. A hatchery that secures all its hatching eggs from U.S. Pullorum-controlled flocks or also from U.S. Pullorum-passed and U.S. Pullorum-clean flocks is recognized as a U.S. Pullorum-controlled hatchery. Chicken hatching eggs from similarly qualified flocks may be incubated in the same incubator. The custom hatching of poults from eggs produced by nontested flocks is permissible in a U.S. Pullorum-controlled hatchery, providing the incubation of these eggs and the hatching of the poults are done in a separate room with a solid partition and with a separate outside entry and separate ventilating system.

The U.S. Pullorum-passed class gives official status to flocks that are found to contain reactors on the first test, but no reactors on the last test preceding the date of first sale of hatching eggs, poults, or breeding stock if (1) all pens containing reactors are sold as market birds or are segregated to the satisfaction of the official state agency to fatten for market and all pens containing no reactors are retested not earlier than 3 weeks after the sale or segregation of pens containing reactors and these pens originally containing no reactors are again found to contain no reactors; or (2) all reactors in the flock are removed from the premises immediately; all pens that contained reactors are retested at intervals of not less than 30 days until all birds pass a negative test; and all birds in the entire flock pass a negative test within 14 days after the negative test of all birds in the pens that contained reactors. Such flocks are recognized as U.S. Pullorum-passed flocks. U.S. Pullorum-passed hatcheries are those that secure all their hatching eggs, including those for custom hatching, from U.S. Pullorum-passed flocks or also U.S. Pullorum-clean flocks. No chicken eggs may be incubated in the same room with U.S. Pullorum-passed turkey eggs and no chicks may be brooded in the same room with U.S. Pullorum-passed turkey poults.

U.S. Pullorum-clean flocks are those that contain no reactors on the first or any subsequent test. However, if on any one of these tests not over 0.5 per cent of the flock are apparently shown to be reactors, the flock owner has the right to submit all the apparent reactors to the laboratory that conducted the official test and, if upon autopsy the bacteriological examination fails to reveal evidence of pullorum infection, the flock is recognized as a U.S. Pullorum-clean flock. If the bacteriological examination shows that any of the birds submitted for autopsy are infected with the pullorum organism, a retest of all turkeys to be used as breeders may be made at the discretion of the official state agency not earlier than 30 days nor later than 6 weeks after the first test and if no reactors are indicated by this retest, the flock may again be recognized as a U.S. Pullorum-clean flock. U.S. Pullorum-clean hatcheries are those that secure all their hatching eggs from U.S. Pullorum-clean flocks. No chicken eggs may be incubated in the same room except from U.S. Pullorum-clean chicken flocks and no chicks may be brooded in the same room except from U.S. Pullorum-clean hatcheries.

Staphylococcosis. This disease is caused by *Staphylococcus aureus* and *S. citreus* and is becoming more prevalent. In mild cases the

Fig. 143.—Swollen joints and feet in adult turkey infected with staphylococcosis or synovitis. (*W. R. Hinshaw, California Experiment Station.*)

joints and sometimes the feet become swollen and tender so that the bird either rests on its hocks or is lame. In severe cases there is a loss of appetite, the droppings are watery and yellowish in appearance, and death may result within 2 days. No satisfactory treatment has been found.

Streptococcosis. This disease resembles fowl cholera and is another disease in turkeys that seems to be on the increase. The disease is very acute, turkeys usually dying before any symptoms are observed. No method of treatment is known.

Tuberculosis. This disease is much more common in adult chickens than in turkeys, owing in part to the fact that most turkey raisers keep but relatively few turkeys over from one year to another.

Tuberculosis is caused by *Mycobacterium avium* and may be present in a flock of poults without showing any symptoms. In advanced stages of the disease the birds become thin and have ruffled feathers and diarrhea develops. The disease can be positively identified by examining the lesions on the liver, in the bone marrow, on the spleen, intestine, and ovaries. The liver and other organs show raised yellowish nodules that are inclined to be hard and gritty.

There is no cure for tuberculosis. Kill diseased birds and burn dead birds to prevent the spread of the disease. The tuberculin test may be applied to a suspect flock, inoculation being made at edge of the web of the wing. Otherwise, a suspect flock could be sold subject to condemnation when examined by a veterinarian, all birds showing tubercular lesions when eviscerated being destroyed and all others being sold for food.

Since outbreaks of tuberculosis in turkeys usually occur when they have had contact with tubercular chickens, never allow turkeys to mingle with chickens. Sanitary management practices will help to prevent tuberculosis from gaining a foothold in the turkey flock.

6. Controlling Fungus Disease

Fungus diseases are caused by molds and yeasts and occasionally are responsible for considerable mortality in turkeys.

Aspergillosis. This disease is otherwise known as "brooder pneumonia" and is caused principally by a mold, *Aspergillus fumigatus.* The organism, which grows in moldy litter and moldy feed, may attack poults at 5 days of age. Mortality is sometimes very heavy. The organs usually infected are the air sacs, trachea, and bronchial tubes. If the air sacs only are infected, the poults may show no symptoms but if the trachea and bronchial tubes are infected, the poults usually breathe heavily, with a hoarse rattling in the throat.

Upon post-mortem examination, the lungs and air sacs are usually found to be filled with a yellowish cheeselike deposit. Advanced cases often show a greenish mold over the surfaces of the infected areas.

Obviously, the most effective measure of preventing the disease from troubling your flock is to feed clean grain, use clean litter, and keep the brooder-house floor and yards free of the mold. Keep the drinking utensils clean at all times, especially milk containers if they are used in any way. Water pans or fountains on wire platforms help to keep the litter dry.

Favus. A fungus, *Achorion gallinae*, is the cause of this chronic skin disease, which produces yellowish-white lesions on the head and neck and in more advanced cases may cover areas over the body between the feather tracts. The disease usually does not cause much loss, but since human beings are susceptible, especially if they have cuts or scratches on the arms and hands, proper care should be taken to prevent physical transmission of the disease to the person. Remove infected birds from the flock, clean and disinfect the premises, and move the flock to new quarters. The affected birds may be treated by rubbing thoroughly into the lesions an ointment made by placing vaseline in a sealed jar, which is placed in hot water to melt the vaseline, and then adding 5 per cent by weight of commercial Formalin, tightening the cover immediately and shaking until the vaseline hardens.

Moniliasis. Otherwise known as "thrush" or "mycosis" of the crop, this disease is caused by organisms belonging to the genus *Monilia*. The upper part of the digestive tract, especially the crop, is the seat of infection. A catarrhal exudate and yellowish ulcers cover the lining of the crop, mouth, esophagus, and intestines. Infected birds become listless, lose appetite and weight, and tend to stand around with heads drawn back on the shoulder. Unsanitary quarters and lack of proper management are conducive to an outbreak of the disease. Besides removing the flock to clean quarters, thoroughly cleaning and disinfecting the old quarters, a 1 to 2,000 copper sulphate solution may be substituted for drinking water for a few days. To make the copper sulphate solution, dissolve 1 lb. of copper sulphate (bluestone) in 1 gal. of soft water (rain water) or 1 gal. of hard water to which 1 cup of vinegar has been added; heat the mixture if necessary to dissolve the copper sulphate; add 1 tablespoonful of this mixture to each gallon of water. Give this to the turkeys in earthenware vessels or wooden fountains.

7. Controlling Miscellaneous Diseases

There are certain diseases which apparently are not due to any specific organism, but some of them are of considerable importance to turkey raisers.

Bumblefoot. The cause of swollen abscesses on the feet is not known but if these are not attended to in sufficient time, they may cause severe lameness. Cut the skin, remove the pus, cleanse the wound thoroughly, and apply tincture of iodine or an antiseptic ointment. Bandage the wound to help keep it clean and keep the bird in a cage or other place where it can be kept quiet.

Enteritis (nonspecific nature). Enteritis is an inflammation of the intestine and in this case is not due to any specific cause but usually results from an abrupt change taking place in the intestinal tract. Severe chilling during brooding, sudden changes in feeding methods, stampeding due to fright, and heat prostration in older birds may cause such a disturbance in the intestinal tract that inflammation develops. Loss of appetite and a diarrhea usually follow an

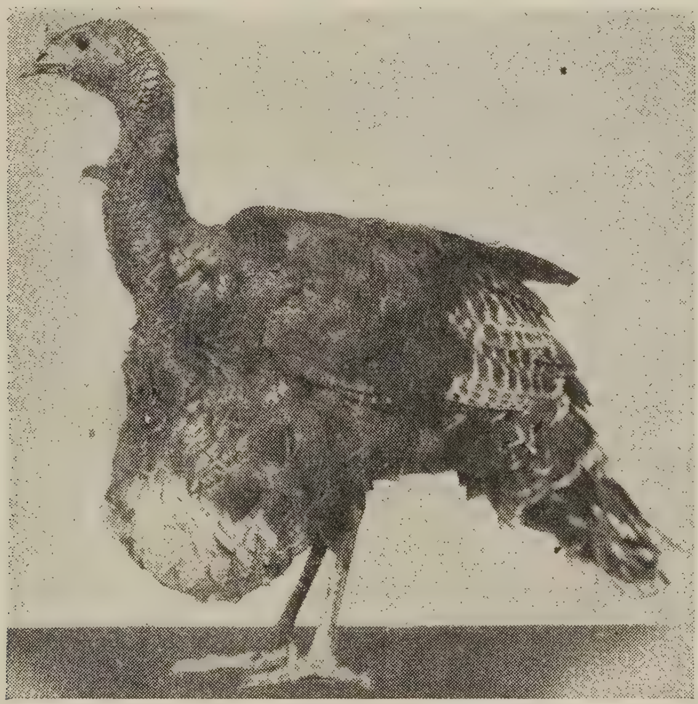


FIG. 144.—Female turkey 8 months old with pendulous crop of about 5 months' duration. (*W. R. Hinshaw, California Experiment Station.*)

outbreak. Follow the rearing and feeding methods outlined in previous chapters, taking care not to make any abrupt changes. This is the best prevention against nonspecific enteritis.

Omphalitis. This condition is due to an infection of the navel in poults at hatching time, inflammation setting in. Faulty methods of incubation and lack of sanitary conditions in the incubator seem to be the principal factors involved. Poults appear weak and drowsy and a scab often forms over the navel. Mortality may be quite high from hatching time up to several days thereafter. Sanitation in incubation, including disinfection of the incubator by fumigation with formaldehyde (as described for controlling the spread of pullorum disease during hatching), will help to control omphalitis.

Pendulous Crop. Also known as "crop bound," "baggy crop," "impacted crop," this condition is usually due to feeding troubles but sometimes the tendency to develop pendulous crop is inherited. The crop becomes very much distended and tends to sag, owing to the accumulation of feed and water in the crop. In the early stages the crop contents are quite soft but in later stages a semiliquid mass mixed with dirt and feces causes the lining of the crop to become thickened and diseased.

Males are more often affected than females and birds raised in hot, dry climates are more often affected than birds raised in cooler climates, especially if the humidity is relatively high. Eating large amounts of dry grass and excessive consumption of liquid milk, with no water to drink, are predisposing factors, as is also the excessive consumption of water during very hot weather.

Preventing pendulous crops from becoming serious in a flock is most effectively accomplished by having succulent green feed available at all times, providing plenty of water in addition to liquid milk if the latter is given as a drink, and providing plenty of shade. If you carry on pedigree-breeding work, select breeders from among families that do not have any cases of pendulous crops.

Poisoning. Turkey raisers sometimes lose considerable numbers of turkeys from no apparent cause and in many cases are inclined to condemn the feed being fed. It is very rare, however, that mashes normally prepared for turkeys cause poisoning. If poisoning has occurred, a diligent search should be made for the real cause, which may have been arsenic, copper sulphate in excessive amounts, poisonous weeds, strychnine, or some other toxic material. The danger of poisoning from any of these causes is rather limited because if turkeys are fed liberally a well-balanced diet, they are not inclined to consume toxic substances.

Plants that have been known to cause poisoning in poultry include milkweed; black nightshade; leaves of black locust; cottonseed meal in large quantities; green sprouts of potatoes; and certain young growing plants that produce prussic acid, especially if they are cut or bruised. Seeds of plants known to cause poisoning in poultry include corncockle, crotalaria, daubentonia, and Jimson weed or thorn apple. The seeds of certain lupines, the young shoots of oleander, and the young as well as dried plants of the whorled milkweed are toxic to turkeys. Second-growth Sudan is also reported to be toxic.

Grasshopper bait containing sodium arsenite may cause poisoning if turkeys consume too much of the bait, but when it is spread over the ground thinly there is apparently little danger. Keep turkeys out of orchards being treated with chemical dusts and sprays. Copper sulphate in concentrations greater than 1 to 500 dilution may poison poults but not in concentrations of 1 to 2,000 dilution or less, the latter only being recommended for treating certain specific diseases. Mercuric chloride is poisonous in dilutions as low as 1 to 2,000. Sodium bicarbonate, or baking soda, is poisonous to poults 4 and 6 weeks old if their drinking water contains more than 0.6 per cent of the substance.

8. Keeping Losses from Parasites and Diseases at a Minimum

In spite of all the precautions you take to prevent disease from occurring in your flock, there is bound to be some mortality. Visitors, wild birds, and predatory animals may bring disease organisms to your premises. The feed may become contaminated when it is mixed on the floor of the feed room. The coops or crates in which turkeys are moved harbor organisms of disease if they are not cleaned and disinfected regularly. In these and in other ways disease may be given a chance to ravage the flock. Your problem is to keep losses from disease at a minimum.

Avoiding Epidemics. Turkey raisers who suffer the greatest losses are those who allow a disease to progress until it becomes epidemic, so that a high proportion of the flock is affected and many birds die. At the first sign of sickness in your flock, find out as quickly as possible the nature of the disease and its cause. Then do everything possible to prevent its spread.

The suggestions in Table 49 have been prepared to help you decide what may be the cause of sickness in your flock and what to do to keep it from spreading. The external symptoms of some of the more important deficiency diseases that are due to insufficient supplies of certain vitamins are not included in Table 49 because they were included in Table 21. These nutritional diseases and how to prevent them have already been discussed in Chap. 5.

Remember, of course, that different diseases may produce somewhat similar external symptoms in poults and adult turkeys, so that sometimes it is practically impossible to decide the cause of the trouble without having an autopsy or post-mortem examination

TABLE 49. BRIEF OUTLINE FOR PREVENTING SPREAD OF DISEASES
(Listed in the approximate order of their appearance)

External symptoms	Disease and age usually affected	Cause	Important steps to prevent spread
Weakness, drooping heads and sagging wings, may or may not have diarrhea	Pullorum disease, 1–6 weeks	Bacteria, *Salmonella pullorum*	Isolate infected poults. Send some to state laboratory. Always secure poults from officially tested breeding stock
Heavy breathing with hoarse rattling	Aspergillosis, 1–6 weeks	A mold in musty feed or litter or filth	Clean brooder house, dry litter, put feeders and waterers on wire platforms, and clean and disinfect waterers
Ruffled feathers, unsteady gait, and foamy watery diarrhea	Hexamitiasis, 1–6 weeks	A protozoan organism	Sanitation, especially keeping poults away from adult carriers and their droppings
Weakness, sleepiness, ruffled feathers, sagging wings, diarrhea	Paratyphoid infections, 1–6 weeks	Bacteria of the *Salmonella* group	Consult proper state official to determine which *Salmonella* organism is responsible
Listlessness, ruffled feathers, drooping wings, brownish diarrhea	Coccidiosis, 3–18 weeks	A protozoan organism	Keep poults away from adult turkeys. Keep brooder house clean and litter dry. Sun porches help. Rotate frequently, if on range
Drowsiness, ruffled feathers, head lowered, wings and tail drooping, sulphur-colored diarrhea	Blackhead or enterohepatitis	Protozoa, *Histomomas meleagridis*	Sanitation. Keep turkeys away from chickens and poults away from adult turkeys. Raise in sun porches or rotate frequently on range to prevent soil contamination
Loss of appetite and diarrhea	Nonspecific enteritis, 3–24 weeks	Severe chilling during brooding, sudden changes in feeding methods, and heat prostration	Maintain even brooder temperature. Avoid sudden changes in feeding. Guard against stampeding. Provide shade for older birds

TABLE 49. BRIEF OUTLINE FOR PREVENTING SPREAD OF DISEASES.—(*Continued*)

External symptoms	Disease and age usually affected	Cause	Important steps to prevent spread
Listlessness, loss of appetite and weight, heads drawn back on shoulder	Moniliasis or thrush or mycosis of crop, 4–24 weeks	Monilia, a fungus disease	Clean and disinfect premises. Remove birds to clean quarters. Give 1 to 2,000 copper sulphate solution in place of regular water
Listlessness, sagging wings and drooping tails, great thirst, and greenish-yellow diarrhea	Fowl typhoid, 4–28 weeks	A bacterium, *Salmonella gallinarum*	Remove birds with temperature above 108°F. Transfer others to new range. Avoid contact with droppings. Disinfect feeders and waterers. Do not keep survivors
Nasal discharges, swelling of sinuses, eyes closed	Infectious sinusitis, 7–28 weeks	Exact cause unknown, probably virus	Treat with 4 per cent solution of silver nitrate or 15 per cent argyrol solution. Keep poults separate from breeders
Feet swollen and tender, loss of appetite, droppings watery and yellowish	Staphylococcosis, 7–28 weeks	*Staphylococcus aureus*	No satisfactory treatment known
Small yellowish eruptions over head parts, yellow cankers on and in mouth, scabs on head.	Fowl pox, 12–32 weeks	A virus disease	Prevent by vaccination at 8–12 weeks unless trouble has never been experienced and flock is isolated. Revaccinate all breeders
Crop extended and sagging, filled with soft or semiliquid mass	Pendulous crop, 13–32 weeks	Hot, dry weather. Eating large amounts of dry grass or excessive milk consumption. Hereditary tendency	Provide succulent green feed. Avoid feeding milk without water. Provide plenty of shade. Do not select breeders from families showing tendency
Droopy, dry feathers, poor fleshing	Tapeworms, 13–32 weeks	Several species of tapeworms	Keep flies at minimum. Keep turkeys from droppings. Move feeders and waterers frequently. Keep turkeys separate from chickens

TABLE 49. BRIEF OUTLINE FOR PREVENTING SPREAD OF DISEASES.—(*Continued*)

External symptoms	Disease and age usually affected	Cause	Important steps to prevent spread
Depressed breast, head drawn toward body, darkened heads, sunken sinuses	Trichomoniasis, 16–32 weeks	*Trichomonas gallinae*	Keep turkeys away from stagnant pools, ditches, and puddles
Listlessness, wings and tail drooping, nasal catarrh and swollen snood	Erysipelas, 21–32 weeks	A bacterium, *Erysipelothrix rhusiopathiae*	No reliable treatment. Keep turkeys away from sheep and swine
Listlessness, loss of appetite, increased thirst, high temperature, yellow diarrhea	Fowl cholera, 24–32 weeks	*Pasteurella avicida*	No known treatment. Keep adult turkeys away from poults and keep poults away from chickens. Burn dead birds

made of the internal organs. Most turkey raisers, however, are not in a position to perform autopsies, the reasons for which are discussed later. The suggestions in Table 49 should be of assistance, nevertheless, in enabling you to know what to do in most cases of sickness.

Securing Reliable Autopsy. By studying carefully the information in Table 49 you should be able to accomplish much in preventing most diseases from spreading throughout your flock. If a disease assumes serious proportions in spite of corrective measures taken, have an autopsy performed on one or more birds. Because the internal organs and other parts have to be examined, the autopsy should in most cases be performed in a properly equipped laboratory, where microscopes and other apparatus make it possible to examine various tissues in detail. Have the autopsy performed by a veterinarian, a pathologist, or a bacteriologist.

Take or ship live sick birds that are representative of the major illness in the flock to the laboratory. If it is impossible to do this, take or ship one or two birds which have died quite recently, providing you have kept the birds cool to prevent decomposition. Wrap the birds in several layers of paper. The birds must arrive at the laboratory in good condition or an autopsy cannot be performed. Accompanying the birds should be a sealed, stamped envelope with your name and address and a statement telling about the nature of the disease outbreak, the age of the turkeys affected, the proportion of your flock affected, the size of your flock, external symptoms shown by sick birds, your methods of feeding and management, and any other information that will help the laboratory official to make a proper diagnosis of the cause of the disease. The more fully the flock owner cooperates with the investigator, the greater are the chances of determining the cause of the disease. Once the cause has been determined, proper control measures can be taken to reduce further losses to the minimum.

FIG. 145.—Unsanitary watering equipment is one of the most effective ways of spreading disease in a flock. Regular cleaning and disinfecting helps to prevent the spread of disease organisms. (*University of Maryland.*)

Disinfecting to Prevent Spread of Causative Organisms. An outbreak of disease in your flock is conclusive proof of the presence of disease-producing organisms on your premises and in your flock. The proper disinfection of brooding and rearing quarters and feeding and watering equipment with a reliable disinfectant helps to control the spread of the disease-producing organisms. By a *reliable* disinfectant is meant one that destroys the disease-producing organisms. In order for a disinfectant to be most effective, however, all dirt must be removed from the building and equipment that is to be disinfected.

How to clean and disinfect the brooder house before the poults are put in it has been discussed in Chap. 4. Here we are concerned primarily with the problem of controlling the spread of disease-producing organisms during the brooding and rearing season and in

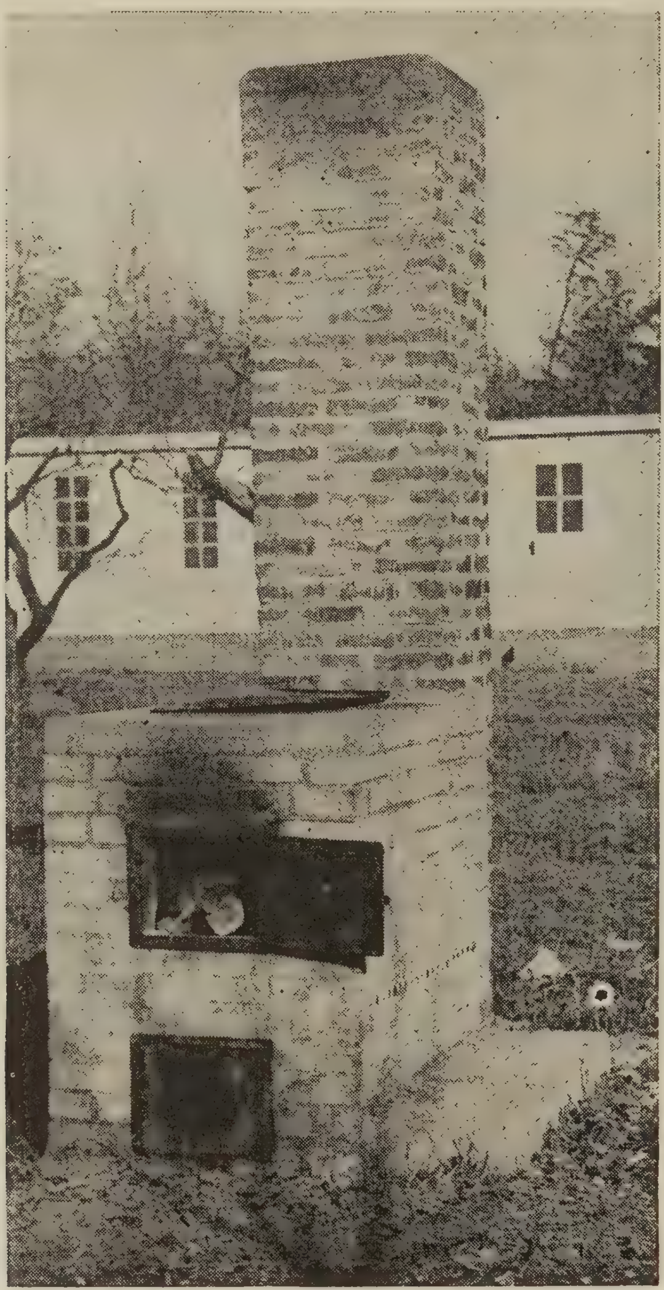


FIG. 146.—An incinerator is one of the best ways of disposing of dead birds and thus preventing the spread of disease. (*University of Maryland.*)

turkey breeding houses. Never spread litter from the brooding and breeding houses on land that is to be used for turkeys within the next 2 years.

To clean a turkey house of any kind, scrub the walls, floor, and equipment with a hot lye solution consisting of 1 lb. of lye in 20 gal. of hot water, taking care not to get any of the solution on your hands or face. After about 1 hr., rinse the lye off with hot water. Then spray the walls, floor, and equipment with a reliable disinfectant, using a pressure pump if possible. Some of the more commonly used disinfectants are discussed briefly. Before buying a disinfectant, especially in considerable quantity, write to the Bureau of Animal Industry, U.S. Department of Agriculture, for a list of disinfectants recognized for commercial use.

Cresol Compound Solution. This is the most highly refined of the saponified cresol solutions and is composed of 500 parts cresol, 350 parts linseed oil, 80 parts potassium hydroxide, and 1,000 parts water. This is an efficient disinfectant and is sold under several trade names. The Bureau of Animal Industry specifications require saponified cresol solutions to contain between 50 and 53 per cent total phenol and not less than 21 per cent by weight of soap; when mixed with water they must form clear solutions and must be used at the rate of 4 fluid oz. per gallon of water.

Formaldehyde. Formalin, used in disinfecting incubators by fumigation, is formaldehyde gas in a 40 per cent solution with water. Consult the state livestock sanitary officials or state veterinarian concerning the method of using Formalin in incubators or follow the instructions given by the incubator manufacturers (see also Chap. 3).

Quicklime or Unslaked Lime is used on yards unexposed to sunlight. Adding 1 lb. of chlorinated lime per 40 gal. of whitewash increases the disinfecting value of the whitewash.

Sodium Orthophenyphenate. This is a highly efficient disinfectant sold in the form of a powder or flakes, which must be kept tightly sealed in a jar until used. It is sold under several trade names. Mix with hot water for best results.

Reducing Losses by Common-sense Rules. In the forepart of this chapter you learned that the annual losses from mortality and other causes amounts to many thousands of turkeys worth several million dollars. This does not represent the total loss to turkey raisers, because among birds that recover from disease growth is retarded, market quality is affected, egg production is decreased, and hatchability is lowered. In addition, many thousands of dollars are spent annually on medicines to cure sick turkeys, in many cases the medicines purchased being relatively worthless. Coccidiosis, blackhead, sinusitis, fowl pox, fowl cholera, fowl typhoid, and pullorum disease have been listed by the Food and Drug Administration of the U.S.

Department of Agriculture as diseases for which there is no known specific remedy.

Much of the mortality that normally occurs in turkey flocks can be avoided if turkey raisers will follow common-sense rules in management (see Fig. 147). The first simple rule is to keep adult turkeys away from poults. The second simple rule is to keep adult turkeys and poults away from chickens of all ages. The third simple rule is to hatch turkey poults in a separate incubator and separate incubator room from chicks. The fourth simple rule is to keep the brooder houses clean and dry and to provide the poults with clean range, if they

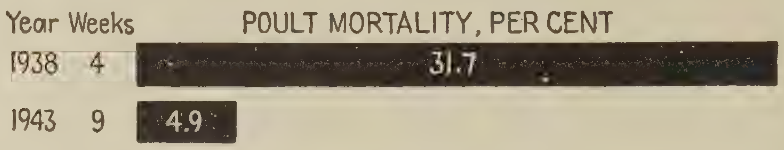


Fig. 147.—Mortality of 31.7 per cent during the first 4 weeks in 1938 was reduced to 4.9 per cent during the first 9 weeks in 1943 by (1) selecting breeders each year from progeny of dams giving best results in hatchability of eggs and viability of poults, (2) keeping breeder houses cleaner, (3) hatching the turkey poults in a separate incubator from chicks, (4) keeping brooder houses cleaner and drier, especially around water containers. (*Graph made from data of P. H. Margolf and W. T. S. Thorp, Pennsylvania Experiment Station.*)

are to be reared on range rather than in sun porches. The fifth simple rule is to use the type of feeder and waterer that will prevent the contamination of feed and water, remembering always that fecal matter is an excellent source of spreading disease. The sixth simple rule in the case of poults reared on range is to move the feeding and watering equipment frequently and prevent the poults from having access to the droppings under the roosts. By following these rules, which are plain common sense, losses from mortality would be reduced considerably. These and additional methods of reducing losses from mortality are given in the summary.

SUMMARY

1. Avoiding excessive losses is largely a matter of good management.
2. Keep adult turkeys away from poults.
3. Keep turkeys away from chickens of all ages.
4. Always remember that most turkey diseases are filth-borne.
5. Use hatching eggs from U.S. Pullorum-passed or U.S. Pullorum-clean flocks.
6. Disinfect and fumigate incubators against pullorum disease, omphalitis, and other diseases.

7. Hatch poults in separate incubators and incubator rooms from chicks.
8. Thoroughly clean and disinfect brooder house before using.
9. Avoid overcrowding, especially as poults grow.
10. Avoid overheating and chilling.
11. Visit brooder house nightly for first 4 or 5 nights.
12. Have patience in teaching poults to learn to eat and drink.
13. Keep litter as dry as possible at all times.
14. Use type of feeder and waterer that will prevent feed and water contamination.
15. Put feeders and waterers on wire or slat platforms.
16. Provide beak cleaners to avoid feather picking.
17. Provide roosts early.
18. Use sun porches attached to brooder house for first 8 weeks.
19. Avoid as far as possible carrying disease organisms from adult turkeys and from chickens to the turkey brooder houses.
20. Feed well-balanced diets, especially with respect to certain vitamins.
21. Rear poults either in sun porches or on clean ground not used for 2 years.
22. On range, move feeders and waterers frequently and keep poults away from droppings under roosts.
23. Clean and disinfect water containers regularly.
24. Rotate flock from yard to yard or to different areas in field.
25. Be sure range is well drained and has no stagnant water.
26. Do everything possible to prevent soil contamination.
27. Provide plenty of shade to prevent heat prostration.
28. Avoid as far as possible carrying disease organisms to the range.
29. Burn all dead birds or bury them in a field that will not be used by turkeys for over 2 years.
30. In case of an outbreak of disease, consult the proper officials of your state college of agriculture.

7. Marketing Turkeys

ALL turkey raisers naturally want to get as good a price as possible for their market turkeys, but many raisers do not know the steps that must be taken to secure the best prices, whether the turkeys are to be sold alive, dressed, or eviscerated. Before you can expect to get the best price for your turkeys, you must decide which method of marketing will be most profitable. Well in advance of the marketing season study the market quotations on live, dressed, and drawn turkeys for birds of different sizes. Many raisers with large flocks sell all their birds alive, while many raisers with limited numbers sell most of their birds dressed or drawn. The various factors determining the marketing method that should be followed by a turkey raiser include number of birds raised, nearness to market, number of customers in community, availability of labor for dressing and drawing, difference in prices for live, dressed, and drawn turkeys, and costs of marketing by different methods. In this chapter, the marketing of turkeys will be discussed through the following activities:

1. Choosing a Marketing Channel
2. Determining When Turkeys Are in Best Market Condition
3. Judging Live Market Turkeys
4. Grading Live Market Turkeys
5. Killing, Plucking, and Eviscerating Turkeys
6. Judging Dressed Turkeys
7. Grading Dressed Turkeys
8. Packing Dressed Turkeys
9. Shipping to Market and Storing
10. Checking on Factors Affecting Prices
11. Using Turkey Meat
12. Selling Feathers and Utilizing Offal

1. Choosing a Marketing Channel

There are numerous trade channels through which turkeys pass from producers to consumers. The most direct channel is direct from producer to consumers, many live, dressed and eviscerated turkeys being sold this way. One of the most complicated channels involves selling live turkeys to a huckster or local buyer, who sells them to a live-poultry buyer, who ships them to a distant market to a jobber or wholesaler, who may sell them to a slaughterhouse operator, by whom the dressed turkeys are sold to a retailer, who disposes of the dressed birds to consumers. Between the most direct and the most complicated channels of marketing turkeys there are many variations (see Fig. 148). How you should market your turkeys depends upon circumstances, such as local demand for live, dressed, or eviscerated turkeys, whether or not you are in a position to kill and dress part or all of your market birds, whether or not there is a cooperative marketing organization in your community, and whether

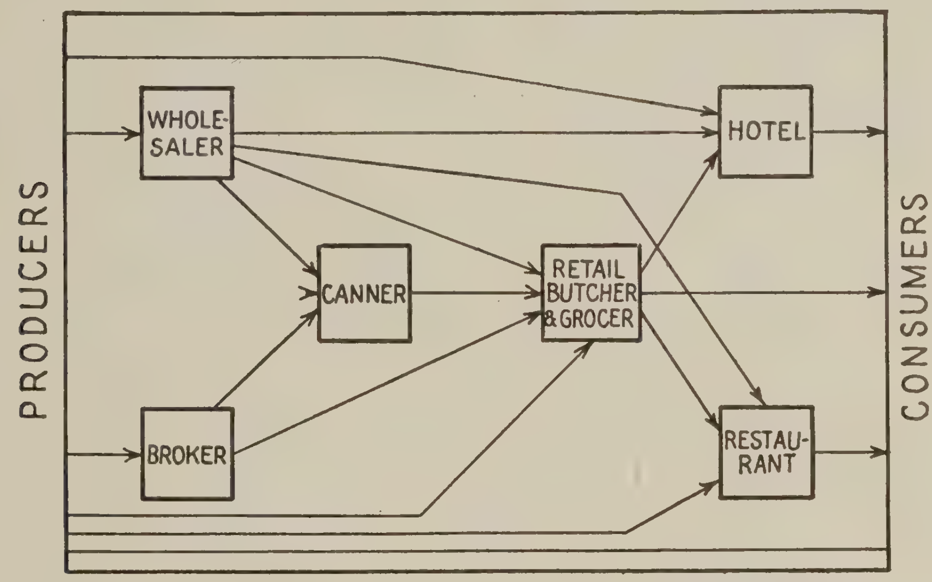


Fig. 148.—Turkey marketing channels. (*C. N. Berryman and M. T. Buchanan, Washington Experiment Station.*)

or not it is more economical to sell your turkeys alive or dressed to a local buyer or dressing-plant operator.

Selling Direct to Consumer. Many turkey growers in the Northeastern section of the country and near large cities in other sections are able to sell their turkeys direct to consumers. This is usually the most profitable method of selling because marketing costs are relatively low and higher prices are received than when turkeys pass through two or three other hands before they reach the consumer. Where labor and facilities are available, it is usually more profitable to sell dressed or evicerated birds than live birds because of the higher prices received per pound.

Selling through Cooperatives. If it is not possible for you to sell your turkeys direct to consumers, the next most profitable marketing channel for most turkey growers is to sell through a cooperative, which dresses and sells your turkeys for you. The objective of a sound cooperative is to secure the highest possible price for you. The cooperatives' overhead and operation costs are usually kept at a minimum, and, since the cooperative is not concerned in making profits, turkey growers who sell their turkeys through cooperatives secure better returns, on the average, than producers who sell to others who wish to make a profit on the transaction. Some of the most successful cooperatives are located in the Northeastern and Northwestern sections of the country.

One form of cooperative marketing that is carried on to some extent in different sections of the country is the pool auction. Producers deliver their dressed turkeys to a railroad station on certain days to enable buyers to offer bids. Arrangements are made in advance to have a refrigerator car at the station in which the dressed birds are loaded after being packed. The successful bidder has his grader and packer grade and pack the turkeys and the producers are paid according to the grade of birds delivered to the station.

Another form of cooperative marketing that has gained considerable impetus during recent years is the pooling of dressed turkeys by producers, the birds being graded and packed by the management of the pools and sold direct to retailers. The Northwestern Turkey Growers' Association is the largest dressed-turkey cooperative in the country, comprising many branch cooperatives and selling hundreds of carloads of turkeys every year. At the time the dressed turkeys are delivered to one of these cooperative marketing centers, producers are paid a certain price and after the turkeys are sold each producer is paid the balance to which he is entitled, depending upon the grade of turkeys delivered, less the selling expenses incurred by the cooperative. Thus, producers usually receive a higher price per pound than could be secured through any other method of marketing except selling direct to the consumer.

Selling to Hucksters. In many parts of the country hucksters buy live turkeys from the producer and sell them to shippers or retailers. Selling turkeys to a huckster is a relatively simple method of disposing of your market birds, although prices received are often less than selling through other channels.

Selling to Jobbers. A jobber purchases live or dressed turkeys from the shipper and sells them on his own account. Since both the shipper and the jobber expect to make a reasonable profit on the transaction, this indirect channel of selling turkeys is sometimes not very profitable to producers.

Selling to Commission Merchants or Wholesalers. The wholesale buyer of live or dressed turkeys acts as a selling agent for shippers, charging a certain percentage of the sale price for his services in selling the turkeys to retailers. Some wholesale buyers buy direct from large producers or from local buyers, who purchase from small producers.

Selling to Poultry-packing Plants. One of the principal channels for marketing turkeys is the large number of poultry-packing plants located in many different parts of the country. Thousands of turkey growers deliver their turkeys to the packing plants. Many packing-plant operators, however, use trucks to pick up the live turkeys on the growers' premises and take them to the packing plants. At the packing plants the turkeys are killed and dressed and packed as dressed birds for shipment to consuming centers, or some of the dressed birds may be eviscerated and shipped to retail outlets, where they are sold to consumers, ready for the oven.

2. Determining When Turkeys Are in Best Market Condition

The greatest demand for turkeys is for the Thanksgiving and Christmas markets, as indicated by the following figures for the marketing seasons from 1938 to 1941 inclusive:

	Before November	During November	During December	After December
Percentage of crop marketed	9.2	40.4	37.4	13.0

These figures show that about 78 per cent of the annual turkey crop is marketed during November and December.

Since the demand for turkeys is greatest during these 2 months, it is interesting to note the average price received by turkey raisers for different periods of the marketing season for the 5-year season October, 1934, to January, 1940 (before the era of price ceilings).

	Oct. 15	Nov. 15	Dec. 15	Jan. 15
Live turkey prices, cents per pound, October, 1934–January, 1940	15.5	16.9	17.6	17.2

These figures show that, on the average, prices in December were higher than prices in October, November, and January. In 1 year higher prices were obtained in October than any of the other three months, indicating a large crop of turkeys, which tended to depress prices as the marketing season advanced. In 2 years, the January price was higher than the December price, indicating a shortage of turkeys to supply requirements. The prices given above are average prices for the United States as a whole, but you should realize that turkey raisers in some sections of the country receive higher prices throughout the marketing season than turkey raisers in other sections of the country. Factors affecting prices are discussed later. At this time it is important to keep in mind that prices received for live turkeys are usually higher during November and December than before or after these months.

For the most part, therefore, try to have your turkeys ready for the Thanksgiving or Christmas market. The age at which they are ready for market depends upon rate of growth, degree of fatness attained, and the inherent body size of the strain. Small-sized strains should be ready to market at about 24 weeks of age and large-sized strains at about 28 to 30 weeks of age. In each case the females are usually ready to market about 2 weeks earlier than the males. Your problem, however, is to determine when your turkeys are in the best condition for marketing so that you will receive as high a price as possible.

Most consumers are willing to pay a higher price per pound for plump turkeys than for thin ones. Between two birds of the same

TABLE 50. AVERAGE LIVE WEIGHT PER BIRD AT DIFFERENT AGES AND APPROXIMATE PERCENTAGES OF DRESSED AND EVISCERATED WEIGHTS, RESPECTIVELY, OF LIVE WEIGHT AND OF EDIBLE MEAT OF DRESSED AND LIVE WEIGHTS, RESPECTIVELY, IN CROSS-BRED TURKEYS

(H. M. Harshaw and R. R. Rector, U.S. Department of Agriculture, 1940)

Age, weeks	Average live weight	Per cent dressed weight of live weight	Per cent eviscerated weight of live weight	Per cent edible meat of dressed weight	Per cent edible meat of live weight
16	6.7	87.0	69.0	53.0	46.1
20	8.5	87.5	69.0	54.0	47.3
24	10.8	88.0	70.0	57.5	50.6
28	13.3	90.0	73.0	61.0	54.9
32	14.1	91.0	76.0	63.0	57.3

body weight, the plump bird almost invariably provides more edible meat than the thin one. In order to give consumers "the most for their money" and thus encourage the consumption of turkey meat, turkey producers should take extra care to have their turkeys in prime market condition at killing time.

The importance of having turkeys well fleshed at killing time is made clear by the Table 50, giving results with crossbred turkeys secured from matings between the Beltsville Small-type White variety and other varieties.

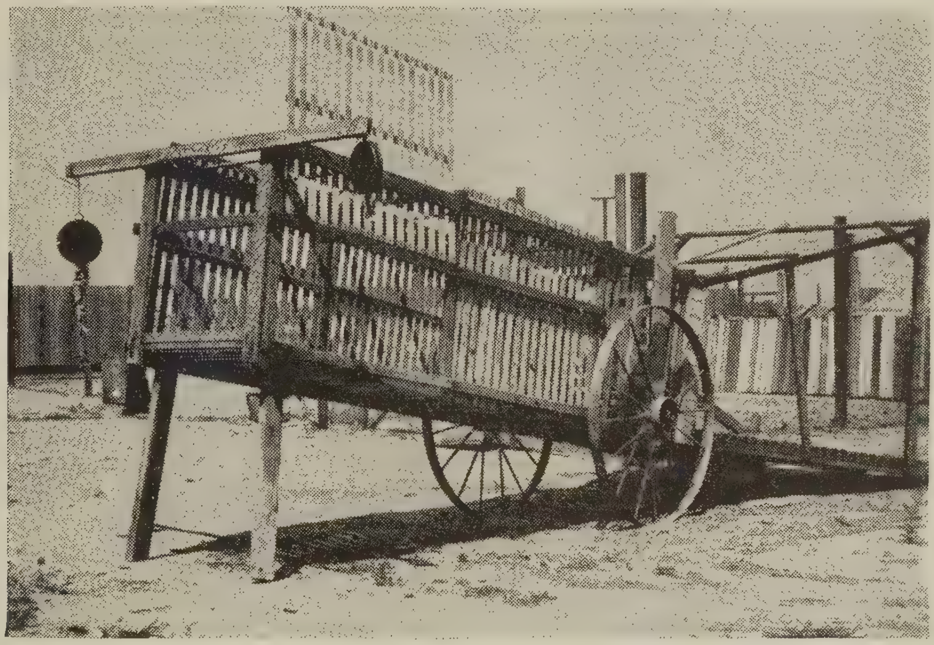


FIG. 149.—Chute for catching, grading, and loading turkeys. (*V. S. Asmundson, California Experiment Station.*)

The data in Table 50 show, among other things, that as the turkeys approached prime condition for marketing, the percentage of edible meat in live weight increased steadily. Between 28 and 32 weeks there was a marked increase in the percentage of fat in the carcass, especially over the muscles of the breast and legs and under the skin.

To determine when your birds have reached proper condition to market, consider these four factors: breast fleshing, thigh fleshing, fattened finish, and absence of pinfeathers. If you intend to market your entire flock at one time, examine a random sample comprising at least 20 per cent of your flock. If you intend to market part of your flock at different times, especially if different ages are mixed in the flock, examine all the birds and then, if possible, separate them into different flocks according to the approximate time each flock should be ready for market. Use a chute such as shown in Fig. 149

for catching the birds to examine them. Turkeys on range should be driven into a corral or enclosure of some kind that leads to the catching chute. A simple, inexpensive device of this kind saves much time as compared with chasing turkeys all over the lot.

Always remember that turkey flesh is very easily bruised and sometimes wings or legs are broken by careless handling. When catching turkeys, move cautiously and do not excite them or they are liable to trample on each other and cause skin or flesh bruises. Bruises on the breast, often caused by grasping a turkey by the legs and then jerking the feet from under it, are very objectionable when the turkey is

FIG. 150.—Left, showing proper method of holding a turkey to prevent flapping, which sometimes lowers the market grade. (*Agricultural Marketing Service, U.S. Department of Agriculture.*) Right, how Warren D. Johnson, a Pennsylvania turkey grower, moves his turkeys. (*Turkey World.*)

dressed for market. To avoid injuries and bruises insofar as possible, seize the turkey between the middle and upper joints of the wing, as shown in Fig. 150, left. Whenever you grasp a turkey by the feet, be sure to lift the front of the bird so that the breast is not bruised.

Determining Breast Fleshing. The amount of turkey meat that a family gets when the housewife buys a turkey is determined more than anything else by the plumpness of the fleshing over the breast. Plump breasts are desirable not only from the consumer's standpoint but also from the producer's standpoint, because plump turkeys should always command a higher price than thin turkeys.

To judge your turkeys for the degree of breast fleshing, have an assistant hold each bird with its back on a table or barrel top with the head toward you. Part the feathers on each side of the keel and with the palms of your hand feel the plumpness of the breast and the degree of fleshing on each side of the entire length of the keel.

Use the following three grades to classify your birds with respect to breast fleshing: *very plump*, *reasonably plump*, and *thin*. A very plump breast is one that is fully fleshed in front, broad and flat across the top and on each side throughout the entire length of the keel. A reasonably plump breast is one that is fully fleshed in front, reasonably flat or at least well rounded over the keel and on each side throughout the entire length of the keel, except possibly with a slight tapering toward the rear. A thin breast is one that lacks plumpness in front

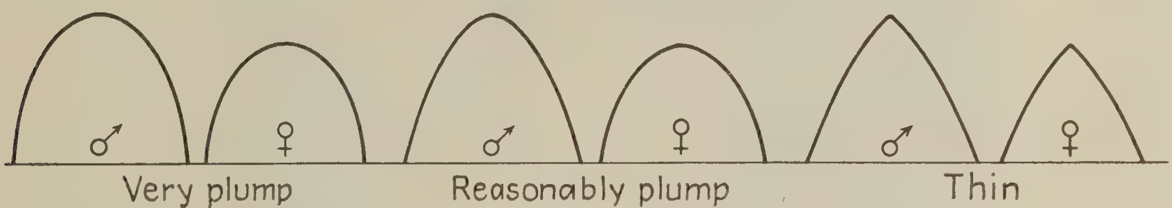


FIG. 151.—Three grades of breast fleshing for determining which turkeys are in prime market condition. ♂ represents males and ♀ females.

and over the keel. While grading turkeys for breast fleshing you will find that the hens tend to have plumper breasts than the toms. Due allowance should be made for this slight difference, and keep in mind that nearly all toms have deeper bodies than hens.

Remember, of course, that the degree of plumpness of breasts of your birds is influenced by the body conformation and fleshing ability of the breeding stock from which they were secured and by the diets you fed your birds and how you managed them, subjects that have been discussed in previous chapters.

Birds with very plump breasts are ready to market, providing they also have plump thighs and a well-fattened finish and are free of pinfeathers. Birds with reasonably plump breasts, providing they meet the other qualifications mentioned, might also be marketed or might be held another week or so depending upon the market situation. Birds with thin breasts should be held until they are in much better finish.

Determining Thigh Fleshing. The thighs of the turkey are the second most important part so far as concerns the relative amount of meat obtained from a roast turkey. While you are grading each turkey for breast fleshing, grade it at the same time for plumpness of the lower thigh or drumstick. Use three grades—very plump, reasonably plump, and thin—depending upon the amount of fleshing present, to classify your birds.

Determining Fattened Finish. The amount and distribution of fat in turkeys are very important factors in determining when they are ready for market. Examine the underside of the web of the wing; if the skin of the web is yellowish in color and feels waxy, the bird probably has a well-fattened finish over its entire carcass, but if the

Fig. 152.—Method of determining degree of fattened finish by making a fold of the breast skin halfway between the front end of the keel and the shoulder. Separate the feathers and roll the skin between the thumb and forefinger of each hand. A very thin roll, such as shown in this picture, indicates very poor finish. (*University of Maryland.*)

web is reddish in color and the skin is thin and lacks a waxy "feel," the bird is not ready to market.

A more satisfactory method of determining fattened finish in your birds is to feel the thickness of a fold of skin on the breast at a place halfway between the end of the keel and the shoulder joint. Pull a few feathers at this place and then determine the thickness of the skin by taking a fold between the thumb and forefinger of each hand. Grade your turkeys into three grades based on the thickness of the fold and the color of the skin. A very thick fold of skin, which is creamy in appearance or feels waxy, indicates a bird with a well-fattened finish. A moderately thick fold of skin, which is slightly creamy in appearance, indicates a bird with a moderately fattened finish. A thin fold of skin, which is pinkish or decidedly pinkish in color, indicates a bird that is not ready for market.

Determining Pinfeather Condition. In dressing turkeys for market, absence of pinfeathers is very important, not only because dark pinfeathers on a dressed bird are objectionable but also because the more pinfeathers there are on a bird when it is killed, the longer the time required to pluck the bird properly and the greater the cost in dressing. Short pinfeathers in dark-plumaged birds are very objectionable because when the dresser attempts to pull them a dark feather pigment remains in the feather follicle, thus discoloring the skin.

There are four places to examine to determine whether or not pinfeathers are present and if so, how many, and especially if there are numerous short pinfeathers present. First, examine the scattered feathers on the underside of an outstretched wing while the bird is held flat on its back on a table or barrel top; this can be done at the same time that you examine the underside of the wing web to determine the degree of fattened finish. Second, look carefully for pinfeathers on the underside of the wing joint. Third, look between the two breast feather tracts. Fourth, look for pinfeathers on the lower thigh or drumstick. Absence of all pinfeathers over the breast and around the shoulder joint is particularly desirable if you expect your turkeys to grade well when they are dressed for market. If numerous pinfeathers are present on your birds, they should be held to be marketed at a later time.

Combining Four Factors in Selecting Birds to Market. When you have made your observations on breast fleshing, thigh fleshing, fattened finish, and absence of pinfeathers, you will know which birds are ready to be marketed and which should be kept for further finishing. Some of the latter may need to be kept another 2 weeks and some another 4 weeks. It will save further handling if these two groups are separated at the time you make your observations on the four characteristics mentioned above. Then each group can be marketed when it is ready, the proper time to market each group being determined by making observations on a random sample of the group.

It is fairly simple to distinguish females from males. In the Bronze variety, after about 14 weeks the adult feathers in fast-growing females have white tips, but these are absent in the adult feathers of males. In the Bourbon Red variety, the adult feathers of the female have dark edges and those in males have black edges. In all varieties the males are more angular in shape, their hocks are broader, and their feet and shanks are larger. If a beard is present on a female, it is smaller, shorter, and finer than in males.

If you are a turkey breeder, the breeding stock for the next breeding season should be selected on the basis outlined in Chap. 2 before any of the progeny of your pedigree matings are marketed. The rest of the progeny of these matings and all young toms and hens secured from your commercial matings should be examined on the basis of the four factors mentioned above so that you can market your turkeys to best advantage.

3. Judging Live Market Turkeys

A considerable portion of the turkey crop raised each year is sold alive on the basis of tentative United States standards for classes and grades recommended by the Federal government. There are four classes: young hens, young toms, old hens, and old toms. The young hens and toms are usually less than 1 year old and are soft-meated with tender skin. The old hens and toms are usually more than 1 year old and have toughened flesh and may have coarse or dry skin.

There are three grades for each of these four classes: Grade No. 1, Grade No. 2, and Rejects. The United States specifications for individual birds in each of these three grades are given a little later. Since many of the live turkeys raised each year are sold on a graded basis, it is very advisable for all turkey raisers to know how to judge live market turkeys.

Practically all turkey raisers would gain a great deal by practice in the score-card judging of live market turkeys. The practice of scoring individual birds is an effective way of learning the relative merits of the different sections of a bird. Scoring several birds and comparing the final scores is good practice in learning how to grade live turkeys for market. The score card given in Table 51 was developed for judging live market turkeys exclusively.

Note that the total score for thickness and distribution of flesh, 35 points, is greater than for any other section. The perfect score for breast fleshing is 18 points and for thighs and wings 12 points, two factors that already have been discussed in determining when birds are ready to market. A total score of 25 points is provided for quality and distribution of fat, another factor also discussed previously in determining when birds are ready to market. Five points are provided for feather condition for picking, the fourth factor previously discussed. This makes a total of 65 points for factors used determining when birds are ready to market.

TABLE 51. SCORE CARD FOR LIVE MARKET TURKEYS
(Official score card developed by the National Turkey Federation)

Scoring factors			Cuts	Entry score
Type and conformation:		(30)		
Symmetry and carriage*	—12 points			
Vigor†	— 5 points			
Shape, length and flexibility of keel	—10 points			
Shape of back	— 3 points			
Fitness for dressing:		(10)		
Feather condition for picking	— 5 points			
Freedom from body injuries	— 5 points			
Thickness and distribution of flesh:		(35)		
Breast	—18 points			
Thighs and wings	—12 points			
Shoulders and oysters	— 5 points			
Quality and distribution of fat (cut for excessive fat):		(25)		
Bloom and color of skin	— 5 points			
Fat in feather tracts†	— 6 points			
Fat between feather tracts‡	— 6 points			
Fat in abdomen§	— 5 points			
Fat on back	— 3 points			
Total	100 points			

* If breed classes are used, cut here up to 5 points for birds lacking breed type and color.
† Turkeys must show enough vigor to endure trip to market.
‡ Cut toms for excessive pouchiness and excessive spongy skin on breast.
§ Cut for excessive fat, and hens showing evidence of laying.

Disqualifications for the live market turkeys:

1. A turkey not strong and steady enough on its legs and feet to endure a trip to market.
2. Any evidence of lack of vigor or ailment that would make it unfit for marketing.
3. A bird that does not grade U.S. No. 1 or better when live, or if it could not grade U.S. Grade A or better when dressed.
   a. Plumage condition of pinfeathers or broken feathers below U.S. No. 1.
   b. Body injuries to prevent qualifying for U.S. No. 1.
   c. Not carrying sufficient flesh or fat for U.S. No. 1.
   d. Keel bones more than slightly curved, and dents over ¼ in. deep.
   e. Any physical deformities.

The other 35 points are accounted for by type and conformation and freedom from body injuries. Desirable type and conformation have been discussed in Chap. 2. Here it need only be pointed out that the type and conformation of the live turkeys being judged for market type are the progeny of the breeding stock you should have selected as outlined in Chap. 2. Freedom from body injuries is largely a problem of careful management of the flock during the growing season and, especially, when catching and handling them at marketing time.

Practice in scoring some of your own birds and other birds in live-turkey classes in competition will make you more efficient in grading turkeys for market.

4. Grading Live Market Turkeys

When live-turkey dealers buy turkeys on a graded basis, paying prices according to the quality of the birds, turkey raisers are encouraged to produce better birds. Turkey raisers who sell their birds according to grade should be paid a higher price per pound than turkey raisers who sell a mixed lot of different grades. That is why it is so important for turkey raisers to know how to select birds that are ready to be marketed and how to grade their own live turkeys.

The U.S. Department of Agriculture has proposed tentative standards for grades of live turkeys, the adoption of which by the live-turkey trade would greatly improve the live-turkey marketing situation.

Most turkey raisers will agree that the specifications for standard individual birds of U.S. Grade No. 1 are very lenient. As a matter of fact, it would probably be in the interests of turkey raisers if there were three grades instead of two, the present U.S. Grade No. 1 being divided into two grades with special emphasis being given to superior fleshing, fattened finish, and freedom from pinfeathers for the first grade. Such a grading system would be more in keeping with actual differences that exist in live market turkeys and would be more in harmony with the specifications for tentative United States standards for grades of dressed turkeys, which are given later.

The following factors not only tend to lower the grade for which live turkeys would otherwise qualify but also lower the price that turkey raisers receive for their turkeys: "overcropped," defects, and deformities.

Turkeys arriving at a dressing plant or slaughtering establishment with three or more ounces of feed in their crops are called "overcropped" and are subject to dockage in price.

Table 52*A*. Specifications for Tentative U.S. Standards for Individual Birds and Buying Grades for Live Turkeys

U.S. Grade No. 1	A bird of this grade must be vigorous and free from external evidence of disease. Must be well fleshed or fairly well fleshed and fairly well feathered. Must be soft-meated, if of a class in which soft meat is a requirement. It must be fairly well covered with fat, and, in this connection, proper consideration should be given to age and sex. May have slight but not serious defects or serious deformities.
U.S. Grade No. 2	Any edible bird below the quality of U.S. Grade No. 1 qualifies for this grade. It must be free from external evidence of disease or other conditions that might render the bird unwholesome for human food. A bird of thin flesh, or lacking in fat covering, or only partially feathered may be included if healthy. May have serious defects, serious deformities, or excessive fat.
Rejects	Any bird below U.S. Grade No. 2 that is extremely emaciated or badly crippled or with other external evidence of disease or unhealthy condition that might make it unwholesome for human food.

Table 52*B*. Specifications for Tentative U.S. Wholesale Grades for Live Turkeys

U.S. Grade No. 1	Each lot of live turkeys must contain not less than 90 per cent of birds of the quality of U.S. Grade No. 1, the balance to be U.S. Grade No. 2, provided no individual containers in the lot shall have more than 15 per cent U.S. Grade No. 2 birds and shall contain no Rejects.
U.S. Grade No. 2	Each lot of live turkeys shall consist of U.S. Grade No. 2 birds or better and shall contain no Rejects.
No Grade	Lots of turkeys containing Rejects shall be classed as "No Grade."

Turkeys having slight defects, such as skin scratches, slightly bruised skin, small breast blisters, small calluses, and slightly scaly legs may still qualify for U.S. Grade No. 1 if they are otherwise satisfactory. Turkeys with dented, notched, or slightly crooked breastbones, slightly crooked backs, or slightly misshapen wings or legs may still qualify for U.S. Grade No. 1 providing they are otherwise satisfactory.

Serious defects that lower turkeys from U.S. Grade No. 1 to U.S. Grade No. 2 include large skin bruises, flesh bruises, large breast blisters, large calluses, very scaly legs, and one broken wing bone without evidence of fever. Serious deformities that also lower turkeys from U.S. Grade No. 1 to U.S. Grade No. 2 include hunchbacks, crooked breastbones, or other definite deformities.

You can readily see, therefore, that turkeys must be handled carefully at marketing time to avoid scratches and injuries of all kinds. If you have any diseased or emaciated turkeys, do not market them, because they will be rejected by the buyer. Grading your own birds to be marketed should help you to get a better price. Always keep in mind, however, that if your birds are of relatively inferior quality at marketing time, no amount of grading on your part will improve their quality; the best that you can do is to grade them as carefully as you can. Your real objective should be to raise turkeys that excel in body type and fleshing ability and are as free as possible of defects and deformities of all kinds.

5. Killing, Plucking, and Eviscerating Turkeys

The greatest possible care must be exercised in killing and plucking turkeys or the market price of the dressed birds will be affected considerably. Faulty methods of dressing cost turkey raisers thousands of dollars annually.

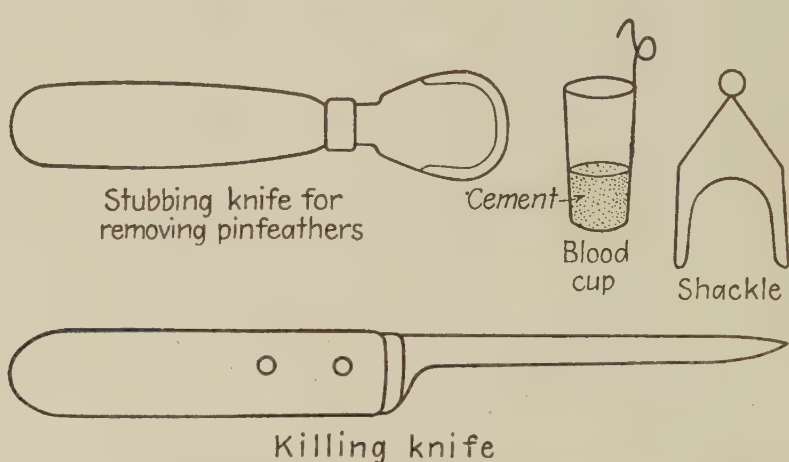


FIG. 153.—Instruments used in killing and dressing turkeys. (*E. Y. Smith and L. E. Weaver, Cornell University.*)

Before killing turkeys, deprive them of feed for about 24 hours. This empties the crop and intestines of feed, which is very important, because a dressed bird with a crop full of feed is unsightly.

Killing Turkeys. To do a good job of killing turkeys, provide the following equipment: a shackle for suspending the birds, a weighted cup provided with a hook for catching the blood, a sharp killing knife, and a stubbing knife for removing pinfeathers (see Fig. 153).

The shackle should be strong enough to support the turkey while it is flapping and should be made to hold the legs at least 6 in. apart so that the feathers between the legs can be plucked.

The blood cup should be 4½ in. across the top, 8 in. deep, weighing about 3 to 4 lb. for medium-sized turkeys, and provided with a sharp hook that will penetrate the mouth parts readily. If the cup is too light, the turkey may swallow blood that has collected in the cup, causing a discoloration of the crop; if the cup is too heavy, the turkey may not bleed freely. Therefore, use a cup of the proper weight for the size of turkey you have.

The blade of the stubbing knife for removing pinfeathers should be dull, so that the skin of the bird will not be cut.

Kill your turkeys by bleeding and braining them through the roof of the mouth. Hang the bird in the shackle so that its wings are on a level with your elbows. Do not lock the wings or a wing bone may be broken. Hold the handle of the killing knife loosely in the fingers and grasp the head of the turkey by the bony part, holding it firmly

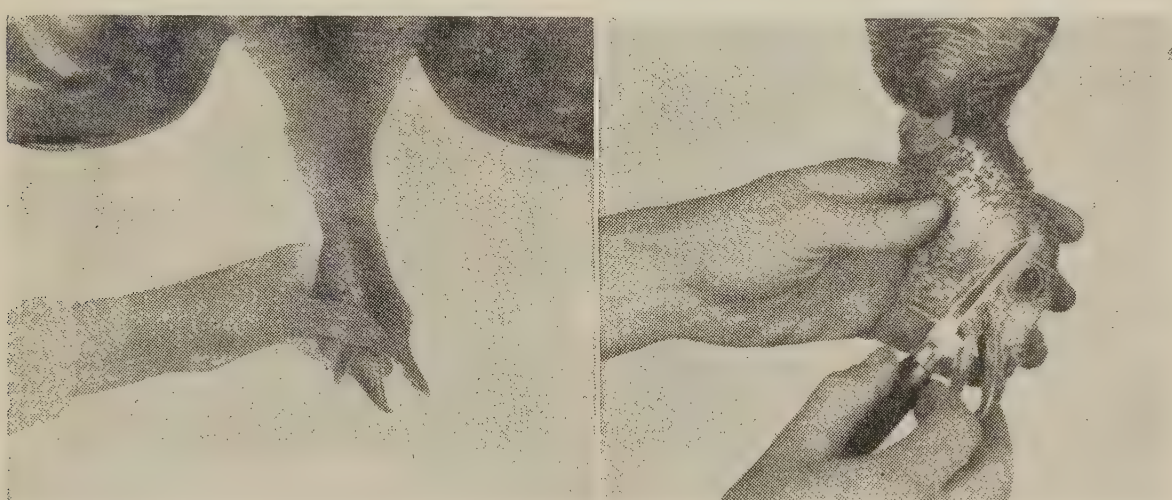


FIG. 154.—Left, holding the mouth open preparatory to sticking. The knife blade must be correctly inserted to ensure good bleeding. Right, the direction the point of the knife should take to pierce the brain. Unless the brain is correctly pierced it will be difficult to remove the feathers. (*Agricultural Marketing Service, U.S. Department of Agriculture.*)

in the fingers of left hand (or right hand if you are left-handed), with the palm as far away from the turkey's head as possible so that your hand will not be injured if the knife pierces the head. With the thumb and forefinger, press firmly on both sides of the head at the juncture of the upper and lower beaks, thus causing the mouth to open sufficiently so that you can insert the killing knife (see Fig. 154, left). Hold the knife with the sharpened end downward and insert it so that the point of the knife will be at the base of the skull to your left. With a quick motion, press the point of the knife into the flesh, lifting the handle upward and cutting downward and to the right (see Fig. 154, right).

The correct place for bleeding is shown in Fig. 155. After the turkey has been stuck for bleeding, it must have its brain pierced to make plucking easier. The point of the knife should penetrate the rear lobe of the brain, as shown in Fig. 155. Piercing the rear lobe of the brain loosens the feather muscles and causes the bird to give a characteristic squawk, after which the tail feathers spread and a convulsion of the body takes place.

Still holding the turkey's head downward with your left hand, fasten the blood cup into the base of the lower beak so that the bird's mouth is held open. Hold the turkey by the side of the head and do not relax the hold until the blood cup is properly fastened into the beak or the turkey may raise its head and swallow blood. If you have bled the bird properly and pierced the brain at the right place, plucking will be easy and should be started immediately.

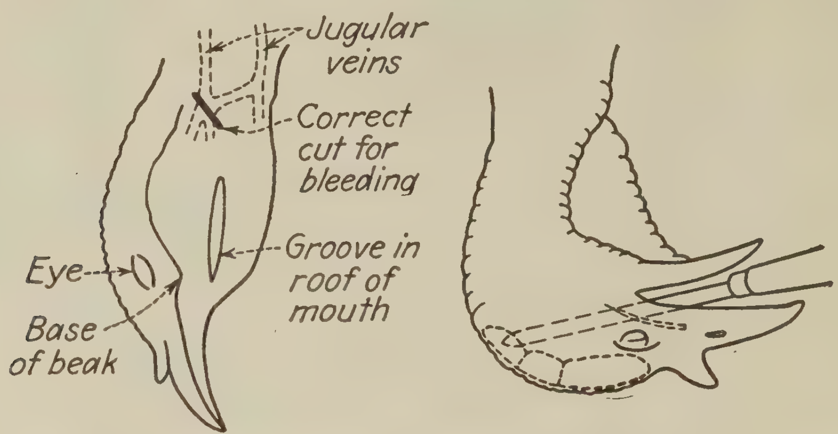


FIG. 155.—Location of veins and method of killing a turkey. (*E. Y. Smith and L. E. Weaver, Cornell University.*)

In some turkey-dressing plants an electrical killing machine is used. This administers an electric shock though a knife, which pierces the turkey's blood vessels to ensure proper bleeding and at the same time electrocutes the turkey and loosens the feathers.

Kosher Killing. Orthodox Jews purchase their turkeys alive and have them slaughtered according to the requirements of certain religious rituals. Turkeys killed for the orthodox Jewish trade are known as "kosher-killed" turkeys. The greater part of either the windpipe or the gullet is cut through in a particular manner. The ritual law of slaughtering is called "shechetah," which may be performed only by a "shochet," who is a certified religious slaughterer. If the shochet is not a rabbi, he operates under the supervision of a rabbi.

Plucking Turkeys. The different methods of plucking turkeys include dry plucking, hard-scald plucking, semiscald plucking, wax plucking, and machine plucking. Dry plucking has been the preferable method of dressing turkeys at home for local trade and before the invention of mechanical plucking devices was used extensively by commercial firms who bought turkeys in large numbers direct from producers. Hard-scald plucking may be employed at home if the turkey is to be consumed at home, although care is necessary to avoid scalding the skin or the roast turkey will not appear on the table in its most attractive form. Semiscald plucking is practiced by producers for local trade and by commercial dressers, many of the latter using molten wax. Machine plucking is practiced by a few producers who dress large numbers and by some commercial dressers.

Dry Plucking. The advantage in dry plucking turkeys over other methods is that the natural "bloom" remains on the skin. One disadvantage in dry plucking is that an inexperienced plucker is liable to tear the skin and more time is needed than with other methods. Dry plucking must be done the moment the bird is killed, while the turkey is still warm.

See Fig. 156 for the different steps to follow in removing the feathers. With the back of the turkey toward you, hold the wings back to back; with the left hand close to the bird's body and with the thumb of the right hand down, grasp the large tail feathers and with a turn of the wrist twist the feathers out as the fist turns upward, as shown in *A*.

Next, as shown in *B*, grasp the main wing feathers in the palm of the hand with thumb up and pluck them with a quick downward jerk.

Then pluck the feathers on the breast and sides, beginning near the wing joint and working toward the legs, as shown in *C*. Grasp the feathers with the whole hand *and twist the hand outward and in the direction of the slant of the feathers;* never pull straight out or the skin is liable to be torn. When one side is plucked, pluck the feathers on the other side.

As shown in *D*, pluck the feathers on the legs next. With thumb upward, clasp the leg in the palm of the hand and move the hand upward with just sufficient pressure to remove the feathers with one movement.

Plucking the back and hip feathers is the next step, as shown in *E*. Grasp as many feathers in the hand as possible and with a twisting motion rotate the forearm inward, repeating until all the larger feathers are removed. Then pluck the small wing feathers between the shoulders with the thumb and forefinger.

F shows how to pluck the neck feathers by pulling against the slant of the feathers.

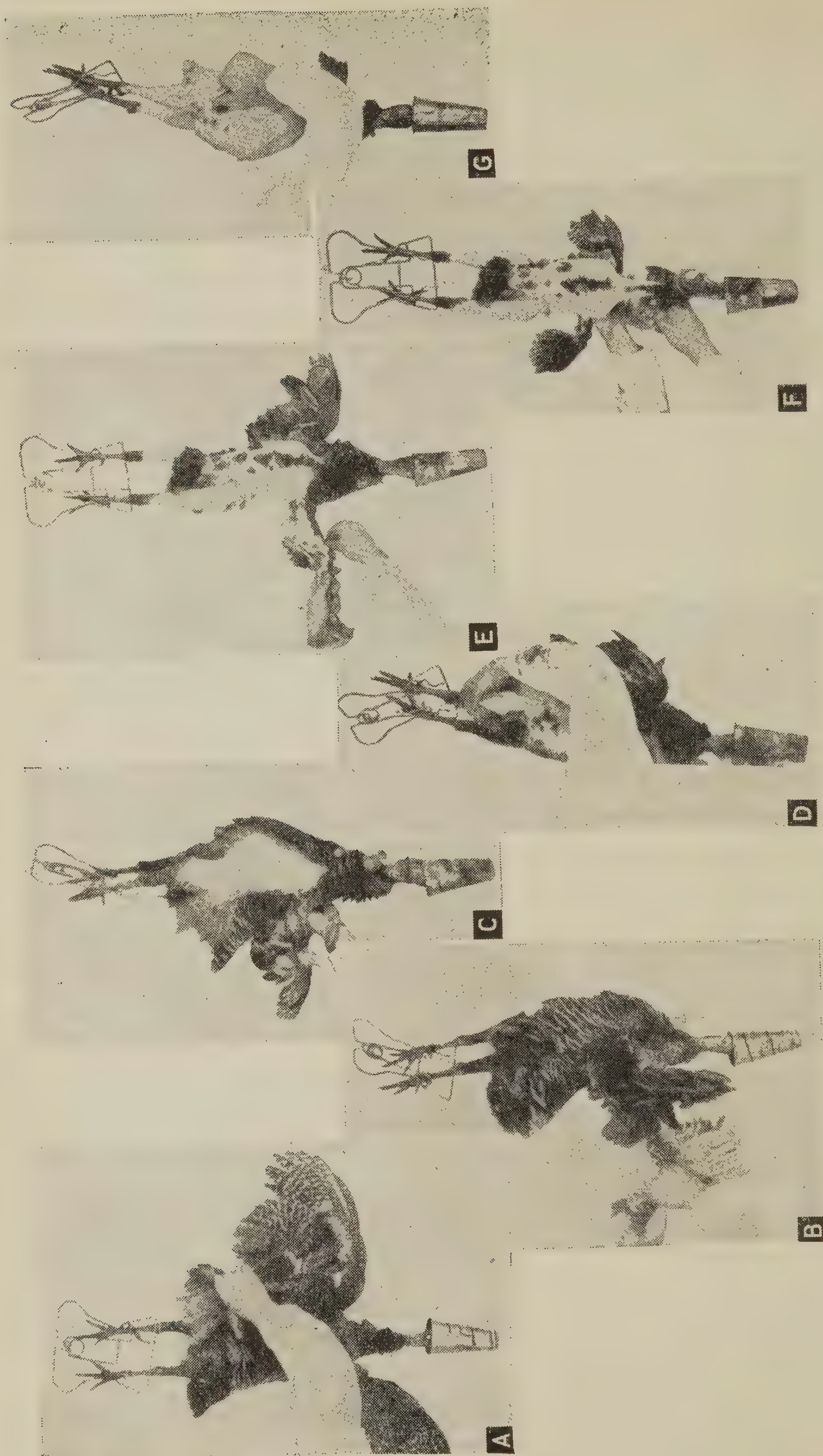


FIG. 156.—For descriptive legend see opposite page.

Now, pluck the feathers between the legs. Finally, hold the wing out with the left hand and with the thumb and forefinger of the right hand pluck the feathers in small bunches, first on the outside and then on the inside of the wing, and then pull out the stiff wing feathers one at a time with a quick downward jerk.

Remove the pinfeathers that may still be left after the bird has been "roughed," as described above, by using a stubbing or pinning knife, such as shown in Fig. 153. If you have selected your turkeys properly, based on feather development, as described previously, there should be very few pinfeathers present. When considerable numbers of turkeys are to be dry plucked at one time, the killers should do the "roughing" only, while the turkey's body is still warm. The "pinning" should be done by others.

Dry-plucked turkeys should be singed before being sold in order to remove all hairs. For small numbers, a candle or alcohol lamp may be used. For large numbers, a blowtorch is quick and effective.

Hard-scald Plucking. Turkeys killed for home use exclusively may be plucked by dipping them for a few seconds in water kept at a temperature of 170 to 180°F. If the water is too hot, the skin will have a scalded appearance.

Semiscald Plucking. Many turkey raisers and most of the turkey-dressing establishments now pluck turkeys by the semiscald method because it is quicker than the dry method. Dip the birds for about 35 sec. in water kept at about 125 to 128°F. In large dressing establishments the birds are killed by hand and then are transported by an endless chain to the water tank, into which they are automatically dipped and withdrawn. The feathers are plucked immediately.

Wax Plucking. Dipping turkeys in molten wax facilitates plucking and removes the hair and practically all pinfeathers, except those

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Fig. 156.—(*A*) In the picking operation, the tail feathers are removed first. They should be twisted, as pulling them straight out is likely to tear the skin. (*B*) The wing feathers may be pulled from both wings at one time, or each wing may be picked separately. (*C*) The feathers from one side have been removed and the operator is ready to begin on the opposite side. (*D*) The fourth step is to remove the feathers from the legs. The legs should be stripped only once or the skin will be blistered. (*E*) Removing the feathers from the back, hips, and wings. The smaller feathers are picked with the thumb and forefinger. (*F*) Removing the neck feathers. The skin of the neck is tough and the feathers can be removed by picking downward against the slant of the setting. (*G*) The last operation in picking. The pinfeathers can be easily removed when clasped between the thumb and pinning blade. (*Agricultural Marketing Service, U.S. Department of Agriculture.*)

that barely protrude from the skin or do not protrude at all. Wax plucking may be used in conjunction with dry plucking or with the semiscald method.

FIG. 157.—(*A*) Showing various stages in killing and plucking turkeys. Left, the turkeys are suspended from shackles hanging from an endless chain. Note operator ready to kill and bleed a turkey. Top right, the turkeys have been automatically dipped in the slack-scalding tank after having been "roughed." Bottom right, the birds have been dipped in molten wax. (*Utah Poultry Producers' Association.*)

Wax plucking is practiced to a limited extent only in dressing turkeys on the farm because many producers do not have the proper facilities for keeping the molten wax at the proper temperature. Electric heating tanks are on the market, however, and with certain other facilities available it is possible to employ wax in the home plucking of turkeys. If wax is to be employed in conjunction with dry plucking, pluck the large wing and tail feathers and most of those between the legs and breast, clip off the beard, and with pliers remove the row of primary coverts on each wing. Allow the carcass to cool to about 70°F. internal temperature before dipping it in the molten wax.

A specially prepared kind of wax is necessary and it should be melted about 1 hr. before dipping. The molten wax must be maintained at a temperature of about 124 to 130°F., depending upon the particular kind of wax used. If an automatically controlled electrically heated wax tank is not available, the proper temperature is maintained by placing the pail or kettle of wax in a large vessel of warm water, hot wax being added from time to time.

Each carcass is then held by the head and feet and individually plunged into the molten wax and agitated for about 5 sec., then withdrawn and held over the kettle for about 30 sec., the process being repeated three times. If the temperature of the wax is a little below 130°F., four or five dippings may be necessary to build up a good coating of wax. After the carcass has been dipped a sufficient number of times, hang it up for about 15 min. to allow the wax to harden or dip it in cold water, kept at a temperature of about 70 to 80°F., for about 1 min. Then peel the wax off the carcass. Do not allow the wax to become too hard or you may tear the skin. Reclaim the used wax by melting and straining to remove the feathers. Very pinny birds and molting hens are not suitable for wax plucking after roughing.

Wax plucking in conjunction with semiscalding is practiced extensively in commercial turkey-dressing plants and to some extent on the farm. For home dressing, semiscald the birds as described previously and immediately pluck the large wing and tail feathers and most of the feathers between the legs and breast. Then allow the remaining feathers to dry thoroughly before dipping the carcass in the molten wax and proceed as outlined above.

In commercial dressing plants, semiscalding is carried out as suggested previously, large wing, tail, and most other feathers being plucked by hand or by a specially constructed wing stripper. Then the partially plucked carcasses are transported on an endless chain through a drying chamber. Upon emerging from the drying chamber, the carcasses are suspended by the head and feet and are carried

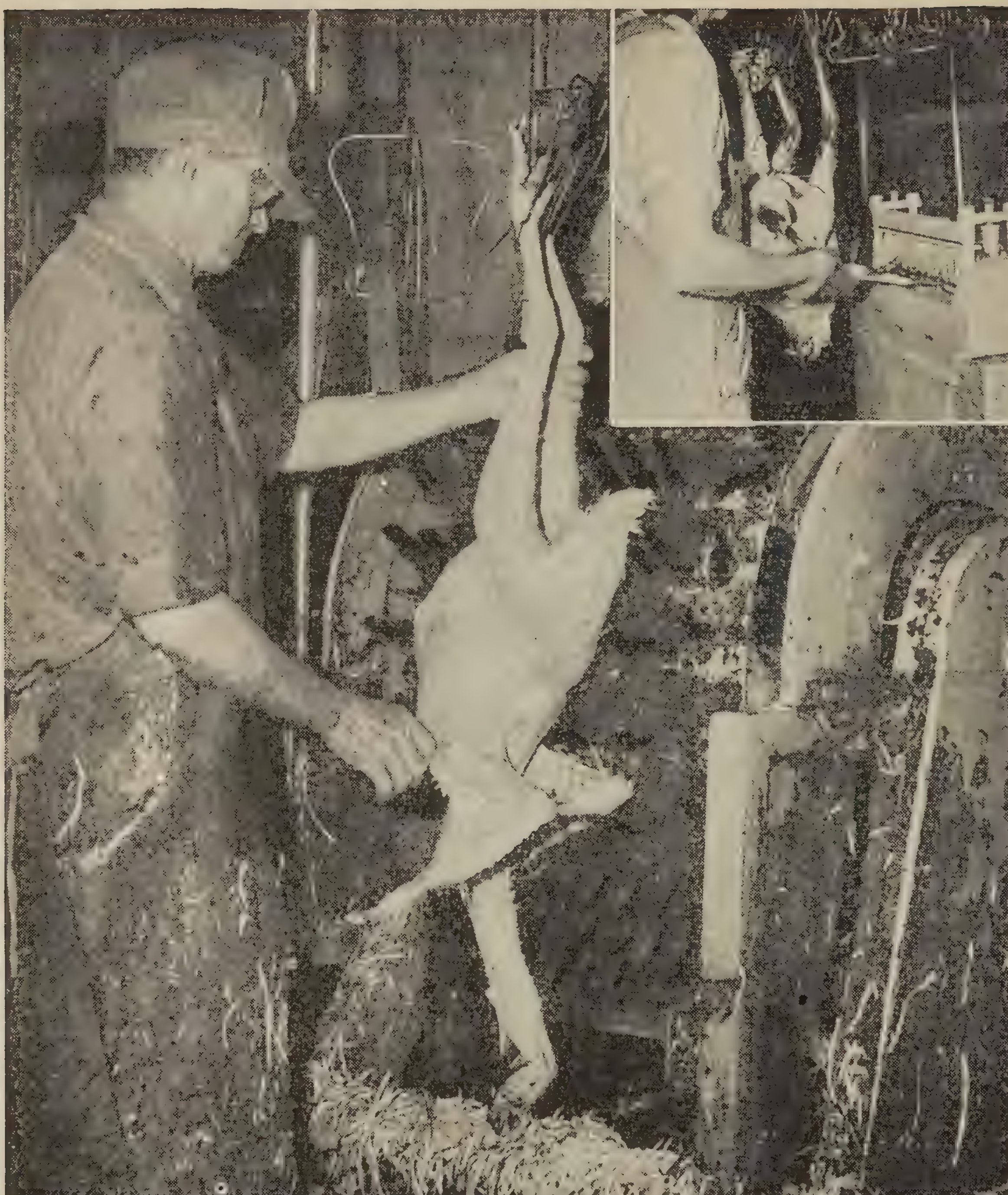


FIG. 157.—(*B*) Insert, sometimes a wing stripper is used to remove long wing feathers before the birds are waxed. Large illustration, a plucking machine equipped with rubber fingers is used for plucking turkeys without waxing them. (*A. A. Walters, Rural Electric Administration, U.S. Department of Agriculture.*)

on the endless chain to the tank holding the molten wax, which should be kept at a temperature of about 125°F. They are dipped once or twice, usually twice, automatically, into the wax. Sometimes deodorants are used in the wax, either Retrol to the extent of 0.2 per cent of the wax or Speedex to the extent of 1 per cent of the wax.

After the carcasses are dipped in wax, they are run through chambers in which they are sprayed with cold water to harden the wax, after which the wax and feathers are removed by hand while the carcasses are suspended in shackles from the endless chain. The wax is reclaimed for further use.

Machine Plucking. Plucking machines, consisting of an electrically driven revolving cylinder equipped with rubber "fingers," are used by some producers and in numerous commercial dressing plants. A bird to be plucked by the use of this machine is first semiscalded and the large wing and tail feathers are plucked by hand. Then the bird is held over the revolving rubber fingers, the bird being turned from side to side until the feathers are removed.

In some commercial dressing plants, machine plucking is practiced after the main wing feathers have been removed by the wing stripper and before the partially plucked birds are carried on the endless chain to the tank containing the molten wax.

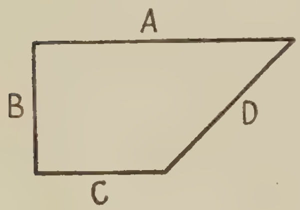
Taking Care of Dressing Details. When a turkey is killed by severing the arteries with a knife inserted into the mouth, a clot of blood usually collects in the mouth. Remove the clot by striking the head, at the base of the skull, against a solid object so protected by canvass or other material as to prevent the blood from splashing all over the killing room, as well as over the dressed bird. Then wipe the head clean with a slightly damp cloth.

Remove any feces present in the intestine by pressing on the abdomen with the thumb just below the posterior end of the keel and moving the thumb toward the vent. Use a sponge to remove any feces from the vent. Feces present in the lower part of the intestinal tract, if not removed, may cause a discoloration of the flesh, this condition being called "greenstruck."

Use a scrub brush to clean the feet. Place a stool near a tub of warm water and rest the turkey breast down on your left leg. Several strokes of the brush may be necessary to remove all the dirt. Then dry the feet thoroughly with a cloth so that the carcass will not be soiled when the dressed bird is hung up to cool.

As pointed out previously, turkeys should be starved for about 24 hr. before being killed so that no feed will remain in the crop. If, however, you kill turkeys with feed in the crop, remove the feed by making a slit 2 or 3 in. long in the skin along the side of the neck so that the incision will not show from the front. Do not cut into the crop. Insert two fingers through the incision and carefully loosen the crop without tearing the crop lining. If feed in the crop is not removed, the flesh around the crop is very liable to become contaminated and may acquire a sour taste.

Sew the slit made in the skin with white thread used double. First, knot the thread and then insert the needle just above the slit; second, draw the thread through to within 1 in. of the knot and then slip the needle back between the threads that were not drawn through the skin and pull tight. Use an overlap stitch, drawing the edges of the skin snugly together and, finally, draw the needle between the skin and the loop of the last stitch and, after drawing tightly, cut the thread about ½ in. from the knot. Torn skin resulting from faulty plucking should be sewn in the same way.



No.	A	B	C	D
1	15	7½	7½	10½
2	18	9	9	12½
3	20	10	10	14
4	22	11	11	15½

FIG. 158.—Showing the shape of head wraps for turkeys. Under *A*, *B*, *C*, and *D*, the length of each side is given in inches for dressed birds of different sizes. No. 1 is for small hens; No. 2 for small toms and large hens; No. 3 for medium-sized toms; No. 4 for large toms. Note that *A* is twice the length of *B* and *C*.

Wrap the heads with brown, parchmentized, kraft paper waxed on one side, being sure to place the waxed side next to the turkey's head. The dimensions of head wraps to use for turkeys of different sizes are given in Fig. 158 and the method of wrapping is shown in Fig. 159.

Cooling Dressed Turkeys. It is very important that dressed turkeys be thoroughly cooled as soon as possible, especially if the weather at killing time on the farm is at all warm. The animal heat must be removed from the carcass as quickly as possible or spoilage may result. Decomposition may set in within 8 hr. after killing time if dressed birds are held at a temperature of 32°F. or higher. Cooling to a temperature of 32°F. at the middle of the carcass is desirable. If air cooling is not practicable, cooling in ice water may be practiced. Insert a thermometer into the vent until it reaches approximately the center of the carcass. Where mechanical refrigeration is available and the room temperature is maintained near the freezing point, at least 24 hr. are needed to reduce the body temperature of the carcass before dressed birds are packed for shipment. A brine-spray method of cooling has been developed that materially reduces the time needed to cool the carcasses. Under no circumstances should turkeys be taken from the cooling room and packed for shipment in a warm room.

Eviscerating Turkeys. Preparing a turkey for the oven consists of removing the head, shanks, and feet and withdrawing the viscera

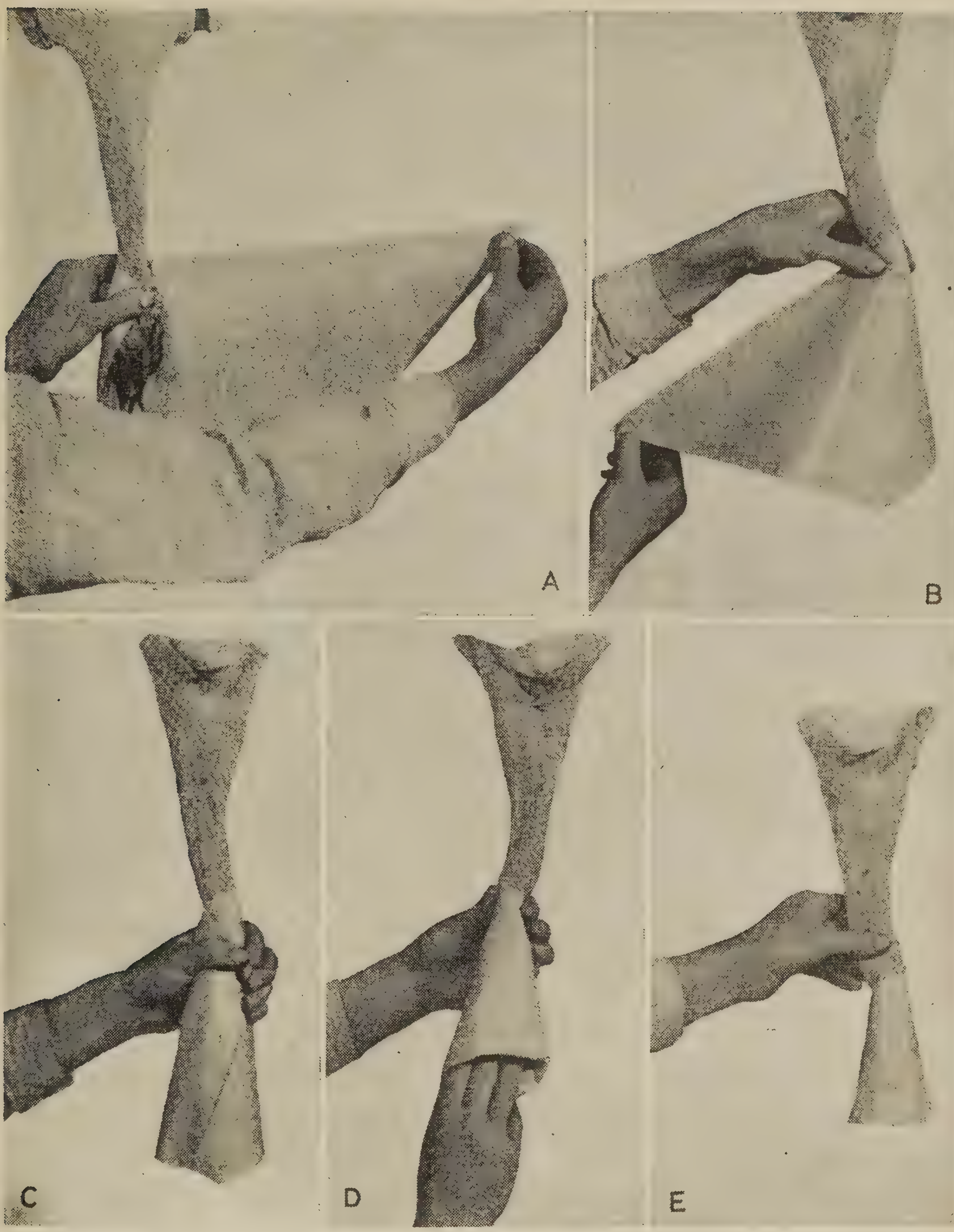


FIG. 159.—(*A*) Beginning the wrap. Always keep the wrapper stretched tight. (*B*) The second stage; the long end of the paper is directly opposite where it was in the beginning. (*C*) The third stage; the whole length of the paper has been used twice in encircling the head. (*D*) The fourth stage; the paper is tucked tightly between the head and the opposite side of the wrapper. (*E*) The completed head wrapper. If it is properly put on it will be impossible to remove the wrapper without tearing it. (*Agricultural Marketing Service, U.S. Department of Agriculture.*)

or internal organs. Eviscerated turkeys are often referred to as "drawn" turkeys. Ordinarily, however, a drawn turkey is one from which the head, shanks and feet, crop, windpipe, esophagus, and entrails have been removed, whereas an eviscerated turkey also has the lungs and oil sac removed. The edible viscera consist of the heart, liver, and gizzard, and the inedible viscera consist of the windpipe, lungs, and the entire intestinal tract.

The thigh or drumstick contains many tendons. Withdrawing the tendons before eviscerating the turkey is recommended for supply-

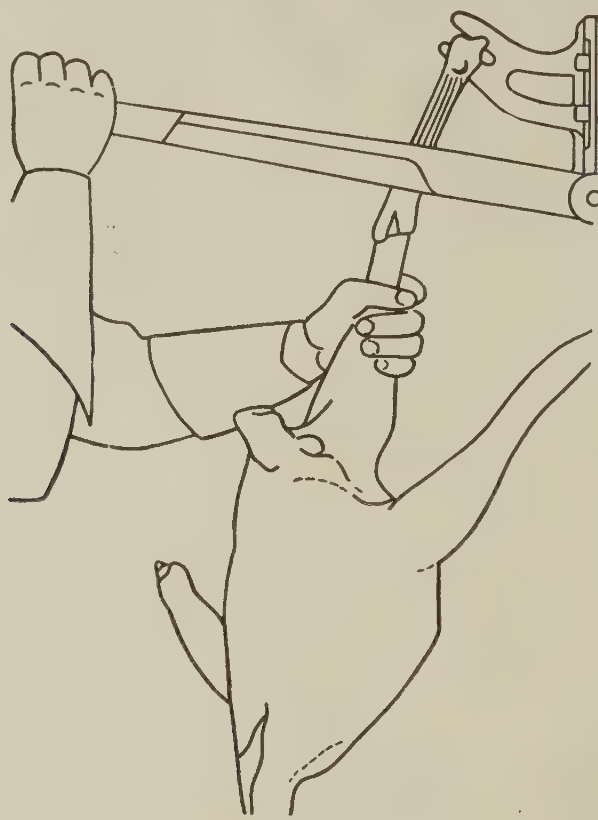


Fig. 160.—Turkey sinew extractor. (*S. G. Mathewson, Massachusetts.*)

ing a high-class trade. Specially made instruments are available for withdrawing the tendons. The device shown in Fig. 160 is attached to the wall at convenient height. The upper bracket of the device is for suspending the turkey from the foot, and the handle, equipped on one side with a bracket to hold the leg in position just above the hock joint, is for withdrawing the tendons. The leg is held securely in place by the left hand and the right hand forces the handle downward and the tendons are withdrawn.

In eviscerating turkeys, the greatest possible care should be exercised so that the carcasses when ready for the oven will have a most pleasing appearance. Slit the skin along the back of the neck from the base of the head to the shoulder. Remove the head and cut the neck muscle at the shoulder to remove the neck. Loosen the gullet, crop, and windpipe in order that they may be removed from the rear end of the bird. Inserting two fingers along the backbone, loosen the heart and lungs, one on each side of the backbone, and remove them from the rear. Fold the neck skin and wings over the shoulders, and place the carcass on its back. If the tendons have not been extracted previously, remove each shank by bending the leg downward and backward and sever the joint from the front. Do not cut the flesh above the joint; otherwise, when the bird is cooked the meat shrinks from the joint.

Make a small incision in the abdomen along a line from the end of the keel to the vent but be sure not to cut the intestines. Insert the left forefinger into the opening. Then make an incision encircling the vent. By inserting the hand into the body cavity, the gizzard is grasped and all the internal organs are removed by pulling gently on the gizzard. Remove the heart, liver, and gizzard from the intestines and slit the gizzard lengthwise to remove its contents of feed. Detach the bile sac from the liver, but be careful not to break the sac. Remove the oil sac at the base of the tail.

Wash the eviscerated carcass thoroughly inside and outside.

Several packing-plant operators make a specialty of commercially eviscerating turkeys for sale direct to retailers. Only the best birds are selected. The dressed birds are singed by a gas flame while they hang on the mechanical conveying overhead track used in killing and dressing. In some packing plants tendons are removed before the dressed birds are eviscerated.

The evisceration process is performed while the birds rest on rustless steel trays that are automatically conveyed by an endless belt so that the birds pass slowly from one operator to another, each of whom performs a special task. As soon as the birds are opened, they are examined by a government inspector, who condemns unfit birds After passing inspection, the head and feet, neck, and viscera are removed in successive steps. The conveyer carries the eviscerated birds and giblets to a high-pressure washing tank. Giblets and neck are wrapped and placed inside the bird, which is then wrapped in cellophane or a "stockinet." The bird is then weighed, labeled, and packed for quick freezing. Eviscerated birds are packed individually or in boxes of six, quick freezing usually being done by the open method at $-5°$ to $-30°$F., with or without fans, or by freezing between refrigerated surfaces under pressure at subzero temperatures.

TABLE 53. SCORE CARD FOR JUDGING DRESSED AND EVISCERATED TURKEYS
(Official score card developed by National Turkey Federation)

	Points	Cuts	Final score
1. Scoring factors for dressed turkeys:			
Thickness and distribution of flesh:	(35)		
Breast	18		
Thighs and wings	12		
Shoulders and oysters*	5		
Quality and distribution of fat:	(20)		
In feather tracts†	6		
Between feather tracts†	6		
Abdomen‡	5		
Back	3		
Dressing and condition:	(25)		
Bleeding	5		
Bloom and color of skin	5		
Pinfeathers, ink stubs, and hair	5		
Dressing and other injuries	5		
Cleanliness, empty crops, and head wraps	5		
Type of conformation:	(20)		
General symmetry	5		
Shape, length, and flexibility of keel	10		
Neck and legs	3		
Back	2		
Total	100		
2. Scoring factors for eviscerated turkeys:			
Thickness and distribution of flesh:	(35)		
Breast	18		
Thighs and wings	12		
Shoulders and oysters*	5		
Quality and distribution of fat:	(20)		
In feather tracts†	6		
Between feather tracts†	6		
Abdomen‡	5		
Back	3		
Dressing and condition:	(25)		
Bleeding	5		
Bloom and color of skin	5		
Pinfeathers, ink stubs, and hair	5		
Dressing and other injuries	5		
Cleanliness and fresh appearance	5		
Type and conformation:	(20)		
General symmetry	5		
Shape, length, and flexibility of keel	10		
Neatness of trussing	3		
Back	2		
Total	100		

* The term applied to those portions of the thigh muscle that fill the two cavities in each half of the hip bone.
† Cut for excessive spongy skin on breast. ‡ Cut for excessive fat and hens with large anal openings.

Disqualifications for dressed carcasses:

1. Positive evidence of spoilage. 2. Feed in crop.
3. Carcasses not qualifying as U.S. Grade A or better, for description of which see next section.

6. Judging Dressed Turkeys

Since it is common practice to sell dressed turkeys on a graded basis, it is very important for turkey producers to understand the principles of grading. This is best accomplished by first practicing judging dressed turkeys by scoring them. Even though you may be able to determine when live turkeys are in prime condition for marketing and can grade live market turkeys correctly, you will not be in a position to appreciate how defects in killing and plucking as well as other factors affect the grading of dressed turkeys until you have had practice in judging them. A live turkey may have been well fleshed and of excellent quality but may be poorly bled, the skin torn, the carcass bruised, or a wing broken, any one of which defects affect the grading of the dressed bird.

Turkey producers and dealers in all parts of the country need much more training in judging dressed turkeys, particularly from the standpoint of determining the relative importance of different factors that influence grading. Staging dressed-turkey exhibits at turkey shows should be encouraged. The score card given in Table 53 may be used as a guide in giving training in judging. Particular note should be made of the relative number of points given to the different sections of the dressed birds.

In Table 53 a scoring method is also given for judging eviscerated turkeys in order that turkey producers and buyers and sellers of turkeys may be able to appreciate the relative importance of different factors affecting the appearance of turkeys prepared for the oven.

Judging dressed and eviscerated turkeys is good practice for all turkey raisers and dealers because they learn much concerning factors affecting quality in market turkeys.

7. Grading Dressed Turkeys

There is always a good demand for dressed turkeys of superior quality. On the other hand, poor-quality turkeys often go begging for a market and are always sold at a considerable discount. Buyers of dressed turkeys are coming more and more to demand uniform grading of all turkeys they buy.

The proper grading of dressed turkeys makes it possible to establish logical price differences according to quality. Since consumers in practically all parts of the country buy dressed turkeys largely on the basis of their appearance and have the same ideas concerning factors affecting quality, it is obvious that grades should be adopted that are uniform throughout the country. A national, uniform set of grades should benefit producers, dealers, and consumers.

Producers should receive a price in accordance with the quality of their birds, those producing birds of superior quality being paid a higher price than those producing birds of poor quality. There is thus some incentive on the part of producers to improve quality by adopting a better breeding, feeding, and management program.

Turkey dealers would benefit from the adoption of a national standard of grading because they could buy their turkeys from distant points with more confidence than when no grading is done or when a grading system in one part of the country differs from that in another part of the country.

Consumers would benefit because they would realize that different prices quoted are based on differences in quality according to grade. More consumers would be satisfied with their purchases if they knew they were getting the grade of turkeys they pay for.

Identifying U.S. Classes for Dressed Turkeys. The United States government has proposed standards for classes and grades of dressed turkeys. The classes include young hens, young toms, old hens, and old toms. Young hens and toms are usually under 1 year of age; in fact, by far most of the turkeys marketed each year are under 8 months of age because many turkey producers replace their entire flock each year and practically all turkey breeders sell most of the young birds raised each year.

Young birds can be distinguished from old birds by the appearance of the flesh and by the flexibility of the posterior portion of the keel. In young hens and toms the flesh is fine-grained and soft, whereas in old hens and toms, used as breeders, the flesh is coarse, somewhat darkened, and tougher than in young birds. In young birds the posterior portion of the keel is still in the cartilage state and is flexible, whereas in old birds the end of the keel bone is hard and rigid. Young hens under 1 year old that have been laying are inclined to have somewhat ridged keels and, if they are quite fat, they are classed as old hens.

A tom approaching maturity and having fairly well-developed spurs is said to be "staggy," indicating that its flesh is not so tender as in younger toms that show practically no spur development. As the young tom develops, the skin over his breast tends to become soft and flabby, eventually becoming puffed and pouchy. In the latter case, he may still be classed as a young tom but his grading is lowered.

Tentative U.S. standards for classes of dressed turkeys have also been proposed according to the method of plucking, chilling, and packing. With respect to plucking, the birds are classed on the basis of having been scalded, semiscalded, or dry plucked, scalded birds not being permitted to qualify for the two top grades. Classes based on the method of chilling include fresh dressed, fresh hard-chilled, and

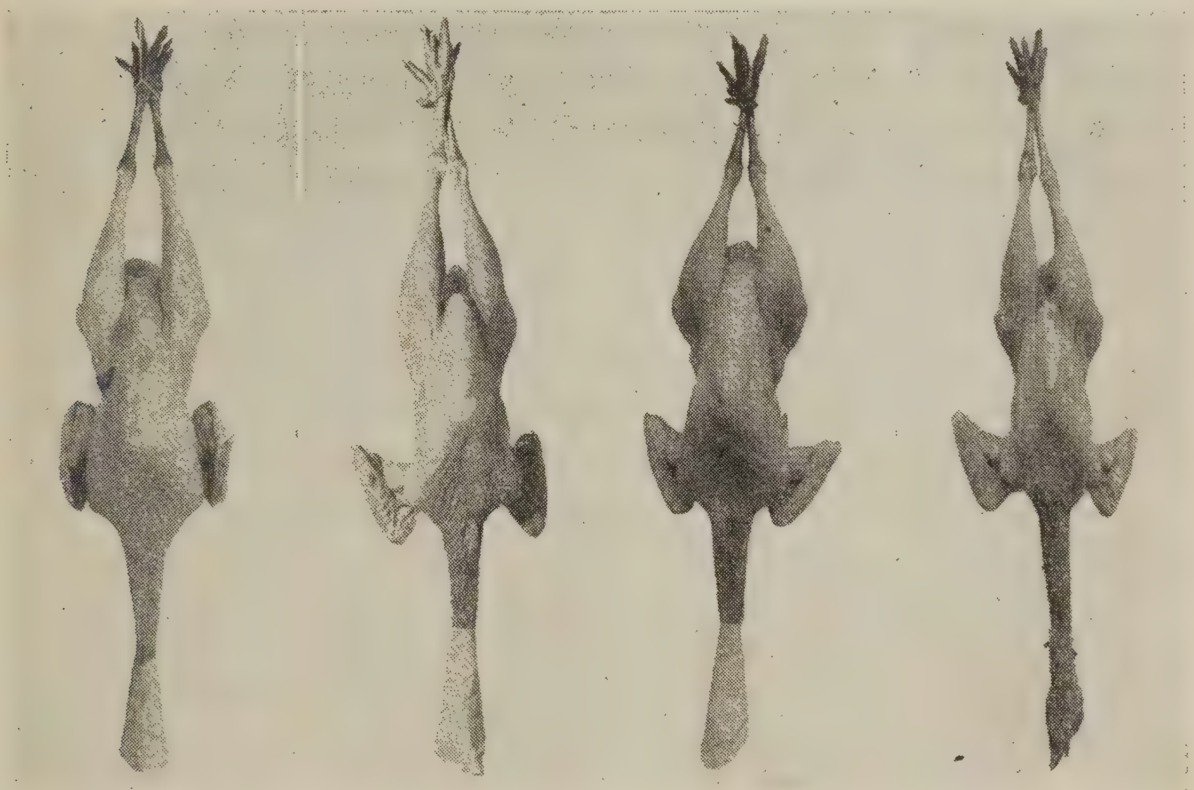


FIG. 161.—Typical specimen of each of the four U.S. grades of young turkey hens, AA, A, B, and C. (*Agricultural Marketing Service, U.S. Department of Agriculture.*)

storage, the last class being for turkeys held at a low temperature for more than 60 days or showing evidence of deterioration from freezing, regardless of time held. Classes for packing are dry and iced, dressed birds packed in ice not being permitted in the top grade.

There are four grades of dressed turkeys: U.S. Grade AA, U.S. Grade A, U.S. Grade B, and U.S. Grade C. Formerly these four grades were called Special, Prime, Choice, and Commercial, respectively. Discarding these terms is fortunate because the first two terms are easily confused and the term "Choice" seems quite inappropriate for the third grade. A representative specimen of a young hen of each grade is shown in Fig. 161. Minimum quality specifications for individual birds for tentative U.S. standards for these four grades of young hens, young toms, old hens, and old toms are given here in as brief form as possible. The major portion of the specifications for each grade applies to young hens, and in each case additional specifications are given that apply to young toms, old hens, and old toms.

U.S. Grade AA. Young, fine-grained, soft-meated female, with full-fleshed breast that is flat and broad throughout the entire length of the keel. Entire carcass fully covered with fat. Must be fully bled, extra well dressed, and free of pinfeathers. No feed in crop and no sewn crop permitted. No flesh bruises allowed; only very slight skin abrasions, bruises, or discolorations permitted, none of which shall be on the breast. Slightly dented keel (not to exceed ⅛ in. in depth) permitted, but no crooked breast or other deformities allowed. No open tears or sewn skin permitted. A broken or disjointed wing, or a broken or disjointed leg not permitted. Must be semiscalded or dry plucked and must be dry-packed.

Young toms must meet the same specifications as for young hens, with due allowance made for fleshing conditions characteristic of males. No staggy condition permitted.

Old hens must meet same qualifications as young hens, with due allowance made for age.

Old toms must meet same specifications as young toms, with due allowance made for fleshing conditions characteristic of old males.

U.S. Grade A. Young, soft-meated female, with well-fleshed breast and with entire carcass well covered with fat. Must be well bled, well dressed, and practically free of pinfeathers, especially on the breast. Only slight flesh or skin bruises, abrasions, or discolorations permitted. Slightly dented keel (not over ¼ in. in depth) permitted. Slightly curved, but no crooked keel permitted. Must be free from deformities. Broken wings above the wing tips or broken legs not permitted. A disjointed leg or wing permitted if only slightly bruised. Birds with crop properly washed or properly removed permitted. No torn skin is permitted. No sewn skin permitted on breast or other fleshy part of carcass, and only slight tears on the back, if properly sewn, permitted. Must be semiscalded or dry plucked.

Young toms must meet similar specifications as young hens, with due allowance for sex, but may be slightly staggy, if soft meated. Old hens must meet similar specifications as for young hens, with due allowance for age. Old toms must meet similar specifications as for young toms, with due allowance for age.

U.S. Grade B. Young female with fairly well-fleshed breast and with carcass fairly well covered with fat. Must be fairly well bled and dressed, and may show scattered pinfeathers over the entire carcass. Slight flesh or skin bruises permitted, but not more than three such defects if on the breast. Fairly numerous skin abrasions or discolorations permitted; abrasions or tears over 3 in. in length on the fleshy parts of the carcass not permitted unless properly sewn. Slight open tears less than 3 in. in length may be permitted if on the back and over the backs of wings. Dented or slightly crooked keel and other slight deformities permitted. One broken wing or one broken leg permitted, if not showing excessive bruise or blood clot and if bone does not protrude through the flesh.

Young toms must meet same specifications as for young hens, due allowance being made for sex. Old hens must meet same specifications as for young hens, with due allowance for age. Old toms must meet same specifications as for young toms, with due allowance for age.

U.S. Grade C. Young female that may be poorly fleshed and with carcass poorly covered with fat. May show evidence of poor bleeding and have numerous pinfeathers over the entire carcass. Numerous skin abrasions and discolorations permitted. Hunchback or other deformities allowed, if bird is fairly well fleshed. Open tears permitted in skin. Broken bones or bird badly bruised so as to make an appreciable part of the carcass inedible not permitted. Bird showing emaciation or external evidence of disease or other condition that renders it unwholesome or unfit to be human food not permitted.

Same specifications as for young hens also apply to young toms. old hens, and old toms.

Determining Major Factors Affecting Grading. From the previous discussion of specifications for each of the four U.S. grades of dressed turkeys, you will realize how important it is to have your turkeys in the best possible condition for market before they are slaughtered. Also, it is highly important to handle all the birds as carefully as possible while catching them for slaughtering, so as not to bruise the bodies, and to do the best possible kind of job in dressing the birds, so as not to tear the skin or otherwise adversely affect their finished appearance and so lower their grade. Too many Grade C turkeys are placed on the market every year. Nobody wants Grade C birds; neither consumers nor dealers. Offering for sale every year so many Grade C turkeys is definitely a producer responsibility.

Defects and deformities of various kinds lower the grade for which many turkeys would otherwise qualify. Defects are usually the result of rough handling prior to slaughtering time or carelessness in dressing the birds. Deformities may be due to inheritance or to improper management in rearing.

FIG. 162.—Left, turkey with bruised breast; this turkey was of U.S. Grade A quality, but because of the bruises on the breast it was placed in U.S. Grade C. Second from left, this turkey was also originally of U.S. Grade A quality, but because of badly torn skin it was placed in U.S. Grade C; if the tear had been properly sewn up or if the tear was on the back or wing, the turkey would have qualified as U.S. Grade B. Second from right, a turkey with a crooked breastbone, causing the bird to be placed in the lowest grade. Right, although a hunch-backed turkey, it is placed in U.S. Grade C because it is well fleshed. (*Agricultural Marketing Service, U.S. Department of Agriculture.*)

Flesh bruises are caused by rough handling, those on the breast affecting the grade attained to a much greater extent than those on other parts of the body.

Torn skin is often due to sticking the bird improperly at slaughtering time, with the result that the feathers are difficult to pluck. In dry plucking, grasping too many feathers at a time or pulling against the lay of the feathers may result in tearing the skin.

Skin abrasions, usually caused by rubbing the skin to remove feathers or pinfeathers or by roughly handling dressed birds, give the skin a rough and discolored appearance and often lower the grade of otherwise good birds.

Poor bleeding is often the cause of lowering the grade because small red spots usually show at the tips of the wings and over the hips or blood marks may show along the thigh and on either side of the breast.

Skin discoloration often results from allowing the dressed carcasses to touch each other when they are placed on the cooling racks.

Crooked keels are very objectionable for the simple reason that they detract from the appearance of the dressed carcass. A bird with a slightly curved keel may be placed in U.S. Grade A if it is otherwise satisfactory.

Dented keels are also objectionable and must not be over ¼ in. deep to permit a dressed bird to be graded U.S. Grade A.

Hunchbacks prevent birds from grading either as U.S. Grade AA or A.

Stagginess in young toms is due to keeping them so long before they are slaughtered that the flesh is no longer fine-grained and tender.

Blue backs are usually due to tail picking in young hens and toms or to injury to breeding hens that have not been provided with saddles during the breeding season.

The information given in Table 54 tells how these defects and deformities as well as other factors affect the grading of dressed turkeys.

The United States government has proposed tentative U.S. wholesale grades for dressed turkeys. Three or more wholesale packages of U.S. Grade AA turkeys must contain not less than 90 per cent U.S. Grade AA birds; the other 10 per cent may be U.S. Grade A birds, but no individual package may contain more U.S. Grade A birds than in the proportion of 2 in 12. Three or more wholesale packages of U.S. Grade A turkeys must contain not less than 90 per cent U.S. Grade A or AA birds; the other 10 per cent may be U.S. Grade B birds, but no individual package may contain more U.S. Grade B birds than in the proportion of 2 in 12. Three or more wholesale packages of U.S. Grade B turkeys must contain at least 90 per cent U.S. Grade B birds or better; the other 10 per cent may be U.S. Grade C birds, but no individual package may contain more U.S. Grade C birds than in the proportion of 2 in 12. All packages of U.S. Grade C birds must contain birds of that grade or better.

TABLE 54. SUMMARY OF SPECIFICATIONS FOR U.S. GRADES FOR DRESSED TURKEYS

(These standards for individual birds represent minimum requirements for each grade, and apply to both toms and hens with due consideration for sex characteristics.)

Grade factor	U.S. Grade AA		U.S. Grade A		U.S. Grade B		U.S. Grade C	
Age	Young	Old	Young	Old	Young	Old	Young	Old
Grain	Fine	Coarse	Fine	Coarse	Slightly coarse	Coarse	Slightly coarse	Coarse
Meat	Soft	Hard	Soft	Hard	Fairly soft	Hard	Fairly soft	Hard

Grade factor	U.S. Grade AA	U.S. Grade A	U.S. Grade B	U.S. Grade C
Staggy condition in young toms	Slightly pouchy	Slightly staggy	Moderately staggy	Staggy
Fleshing	Fully fleshed	Well fleshed	Fairly well fleshed	Poorly fleshed
Breast shape	Broad, full and long	Broad and long	May be slightly narrow	Narrow
Fat covering	Fully covered	Well covered	Fairly well covered	Poorly covered
Flesh over bones	Thick layer	Well covered	Fairly well covered	Poorly covered
Bleeding	Fully bled	Well bled	Fairly well bled	Poorly bled
Dressing	Extra well dressed	Well dressed	Fairly well dressed	Poorly dressed
Pinfeathers	None	Practically free, especially breast	Some scattered all over	Numerous all over
Feathers above the head wrap	None	Fan feathers only	Fan feathers only	Fan feathers only
Flesh bruises	None	Very slight, breast practically free	Slight, not over 3 on breast	Not over ¼ of carcass
Skin bruises	Very slight, none on breast	Slight, breast practically free	Slight, not over 3 on breast	Numerous
Abrasions	Very slight, none on breast	Slight, breast practically free	Fairly numerous	Numerous
Discolorations	Very slight, none on breast	Slight, breast practically free	Fairly numerous	Numerous
Blue backs	None	Tail	Tail to hips	Any amount
Open tears	None	None	Less than 3 in. on back or wings	Numerous any place
Sewn skin	None	None on breast, allowed on back and wings	Permitted any place	Permitted any place
Breast calluses	None	Slight (1 in.)	Not over 3 in., not too dark	Permitted
Broken bones	None	Broken wing tip permitted	One wing or leg, not through flesh	Some permitted
Disjointed	None	One wing or leg is only slightly bruised	Permitted	Permitted
Feed in crop	None	None, or properly removed	None, or properly removed	None, or properly removed
Crop removed—skin not sewn	Not removed	Through small cut in back or side of neck	Through small cut in back or side of neck	Through small cut in back or side of neck
Dented Keels	Slight—Not over ⅛ in.	Slight—Not over ¼ in.	Permitted	Permitted
Crooked keels	None	Slightly curved	Slightly crooked	Permitted if fairly well fleshed
Hunchback and other deformities	None	None	Slightly deformed	Allowed if fairly well fleshed
Plucking	Dry or semiscalded	Dry or semiscalded	Dry, semiscalded or scalded	Dry, semiscalded or scalded
Packing*	Dry-packed	Dry or ice	Dry or ice	Dry or ice
Blisters on freezer burn*	None	Very slight	Moderate	Permitted
Head wrapped	Required	Required, except when ice-packed	Required, except when ice-packed	Required, except when ice-packed
Dirty feet	None	None	None	None
Dirty vent	None	None	None	None
Dirty or bloody head or body	None	None	None	None
Evidence of unwholesomeness	None	None	None	None

*See discussion under Packing Dressed Turkeys.

8. Packing Dressed Turkeys

Few turkey producers are in a position to pack their own dressed turkeys except for retail trade, in which case they are usually packed singly for parcel-post shipment. If you dress your own turkeys and sell them to a packer, be sure to cool them as thoroughly as possible before hauling them to the packing plant. Put a layer of clean straw about 1 ft. thick on the bottom of the truck or wagon and lay the turkeys in tiers breast up, not over three or four tiers deep; otherwise

Fig. 163.—Larger illustration, sorting, weighing, and grading turkeys for packing. (*Union Pacific Railroad.*) Insert, well-finished turkeys ready to be packed. (*Mark Nichols, State Department of Public Instruction, Utah.*)

the lower layer may be damaged severely, owing to the heavy weight. Cover the turkeys with canvas to protect them from the sun and dirt.

In the packing plant, the turkeys are weighed individually and sorted according to weight in order that birds of approximately the same weight may be packed together. All U.S. Grades AA, A, and B birds, except old toms, must be packed with only a 2-lb. variation per bird per box or package, beginning with 8 to 10 lb.; 10 to 12 lb.; 12 to 14 lb.; etc. Old toms must be packed with not more than 5-lb. variation per bird, per box, or package. U.S. Grade C birds must be packed with only a 3-lb. variation per bird per box or pack age.

The box or barrel in which turkeys are to be packed is first lined with high-grade parchment paper, waxed on one side. The empty box or barrel, with paper linings, is then weighed and the weight is stenciled on the outside. This is called the "tare" weight; after the box or barrel is packed with turkeys, it is again weighed and the gross and net weights are marked and stenciled on the outside, the net weight being the difference between the gross and tare weights.

Boxes and barrels should be stenciled plainly, indicating the number of dressed turkeys, and their sex, age, and grade. Dressing-plant operators usually stencil their trade-mark or private brand name on the box or barrel.

Careful and accurate weighing of the unpacked and packed box or barrel is necessary to avoid disputes between seller and buyer concerning the shrinkage in weight that takes place during shipment. Some shrinkage occurs naturally because the dressed birds tend to lose moisture. Under normal circumstances the shrinkage in weight amounts to about 0.5 per cent.

Barrel Packing. Years ago it was common practice to pack turkeys in barrels, especially in the case of turkeys procured in areas a considerable distance from the market. During recent years, however, box packing has superceded barrel packing to a considerable extent because the turkeys arrive at the market in much better condition. This is very important, especially if the turkeys are of superior quality.

If barrels are used, they should be new and free from any odors which might be absorbed by the turkeys. Cut the parchment paper, waxed on one side, used to line the barrel long enough to fold over the top when the barrel is full of turkeys. Use three layers of paper. At the bottom of the barrel and over each two layers of turkeys put a circular piece of paper cut to fit the barrel.

Squat Packing. Squat packing is preferred to side packing when turkeys are packed in barrels. For squat packing in barrels, cool the turkeys on racks with the heads pulled down tightly between the bird's legs. This makes packing easy. Place the turkeys on their butts with backs against the side of the barrel. When small turkeys are packed this way, fill the space left in the center of the barrel with birds placed breasts down. The top layer of turkeys should not protrude more than about 2 in. above the top of the barrel. If this is not done, the birds in the top layer are liable to be damaged in transit. Fold the three thicknesses of parchment paper over the top layer and place a burlap covering over the barrel so that it hangs about 6 in. below the top hoop, which is nailed securely over the burlap.

Side Packing. Place the bottom layer of turkeys on their sides with their backs against the sides of the barrel and the heads and feet toward the center. In packing the next layer, fold the heads under the bottom wings with the necks packed tight against the butts, which rest on the legs of the turkeys in the lower layer. When the barrel is filled, neither the heads nor feet show.

Box Packing. As mentioned previously, box packing is much to be preferred to barrel packing because there is much less danger of "sweating" caused by close contact of the carcasses. If barrel-packed turkeys are allowed to stand for some time or if the temperature is not kept near freezing point all the time, sweating causes a discoloration of the skin. Box packing provides freer circulation of air around each bird than barrel packing, and it is much easier for the cold air of refrigeration to penetrate boxes than barrels.

In assembling the boxes be sure to nail the ends, sides, and bottoms firmly. Use sixpenny cement-coated nails to nail the bottoms, at least two nails at each end of narrow boards and three at each end of wide boards. Use four of the same kind of nails at each end of the sides.

Use at least two strips of parchment paper, waxed on one side, in boxes, one crosswise and the other lengthwise, so that a double thickness of paper is under and over the turkeys, thus providing protection from box rubbing.

Use a box for single-layer packing rather than double-layer packing, because less spoilage is likely to occur, the turkeys can be chilled quicker, there is less skin discoloration, and the birds are more easily inspected.

Any strong, lightweight wood, free of odors, such as spruce, white fir, or cottonwood, is satisfactory for making boxes. Dimensions of boxes suitable for packing dressed turkeys of different weight or size are given in Table 55, the boxes for six to eight turkeys being strongly recommended, because they are easier to handle and much less liable to bulge and break. Since boxes for six to eight turkeys are ½ in. less in depth than boxes for ten to twelve turkeys, it is necessary to pack some of the larger turkeys slightly on the side or slanted so that the keel rests on the side of the adjacent turkey.

Use cleated box covers on all boxes, regardless of the weight or size of dressed turkey packed. Cleats hold the boards of the lid together and facilitate rapid refrigeration by providing an air space between boxes when they are placed on top of one another.

Care and neatness in packing turkeys in boxes are very important, because the appearance of the turkeys when boxes are opened for inspection of prospective buyers often determines whether or not a sale is made. The appearance of the pack also determines the price paid, to some extent. See that all the turkeys fit snugly in the box and are fully protected by the paper lining. The three methods of box packing include breast-up, slant, and side packing.

TABLE 55. DIMENSIONS IN INCHES OF BOXES FOR PACKING TURKEYS IN A SINGLE LAYER, BREAST UP, AND SIDE PACK

Birds per box	Weight of birds, pounds	Inside measurements, inches			Thickness of lumber, inches	
		Length	Width	Depth	Ends	Top, sides, and bottom
6–8	Under 9	25	18	6½	¾	7/16
	9–12	26	19	7	¾	7/16
	12–15	27	29	7½	⅞	½
	15 and over	28	21	8	⅞	½
10–12	Under 9	30	18	7	⅞	½
	9–12	30	19	7½	⅞	½
	12–15	32	20	8	⅞	½
	15 and over	32	21	8½	⅞	½

Breast-up Packing. This is a popular style of packing practically all sizes of turkeys. Elevate the end of the box away from you at least 12 in. higher than the end near you so that each turkey will stay in place as it is packed. Bend the head down so that it is tucked under the back as the turkey is placed breast up with the keel toward the side, the first turkey being placed on one side at the lower end of the box. Place the next turkey on the opposite side of the lower end, one leg of each bird being arranged between the legs of the opposite bird, or both legs of one bird may be placed alongside the opposite bird. Continue packing a bird on each side until the box is filled, making sure that the last bird on each side fits snugly to prevent shifting.

Slant Packing. This style of packing is used principally for toms, thus making it possible to use the same size of box as for hens. Place the first pair of birds in the end of the box with their backs toward you and continue in the same manner with the other birds so that each turkey rests on its hip and wing and with its breast lying against the side of the bird next to it. Tuck the head under the body and the feet under the opposite bird. The breasts of the last pair of birds should lean against the end of the box and should fit very tightly.

Side Packing. This style of packing is not used so much as formerly. Place the first bird on its side in the box with the breast toward you and the second bird, on the opposite side, also on its side but with the back toward you and with the butts of the two birds interlocking.

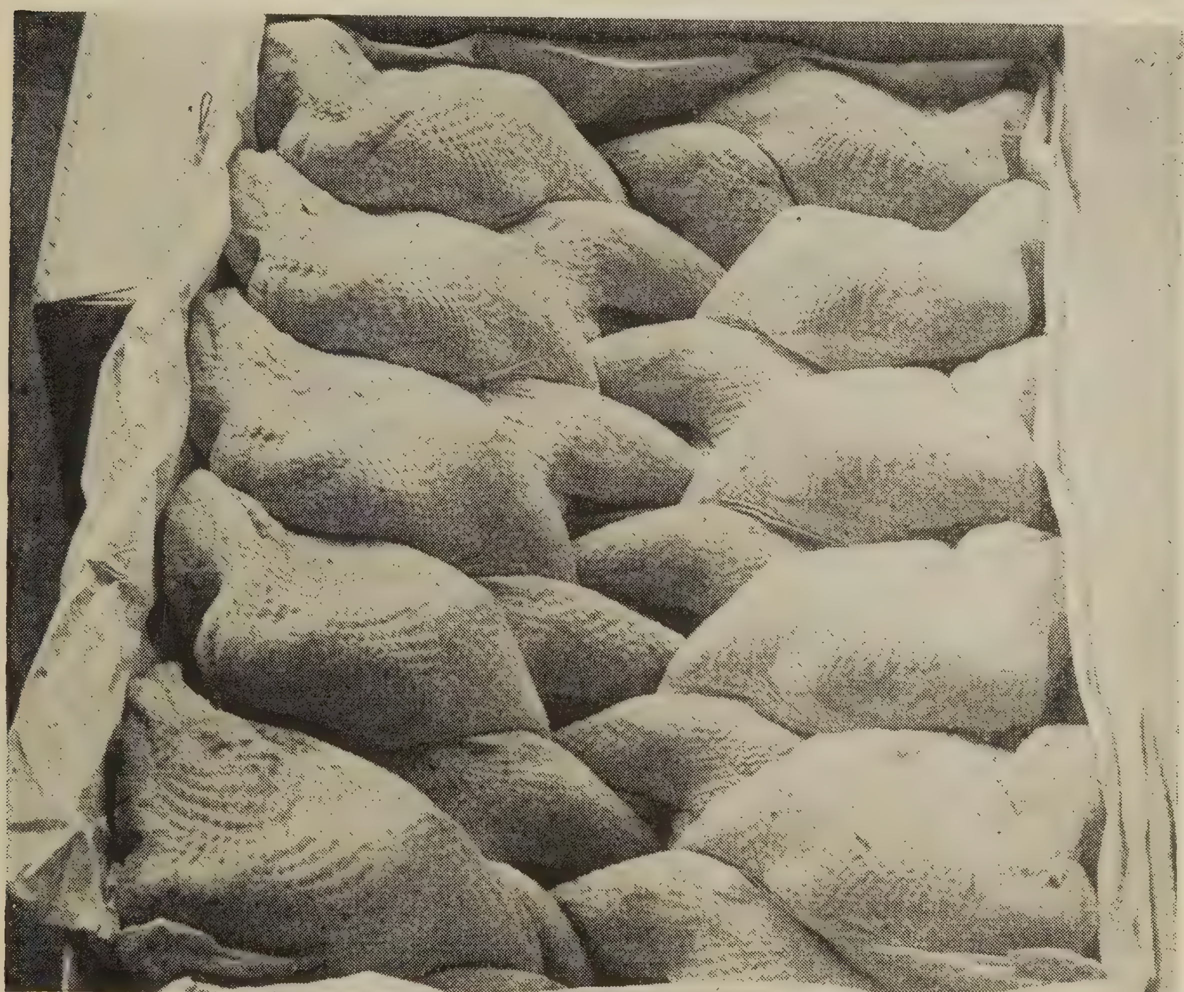


FIG. 164.—A well-packed box of dressed turkeys packed breasts up. Each side liner should be long enough to reach the opposite side of the box. (*U.S. Department of Agriculture.*)

Arrange heads and feet under the bodies and continue with other pairs until box is filled snugly.

Nailing and Strapping Boxes. All boxes should be fastened securely so that they will arrive at the receiving market with the turkeys undamaged. Small-sized boxes are nailed but not wired or strapped; medium-sized boxes are nailed and wired, with one wire around the center of the box; large-sized boxes are nailed and wired or strapped at each end of the box. Use two fivepenny nails at each end of each board, and, if cleated tops are used, four nails at each end of the box are sufficient. For wiring medium-sized and larger boxes, use 13-gauge galvanized round wire having a tensile strength of not less than 300 lb. For strapping the large-sized boxes, use metal straps not less than 3/8 in. turned edge or 1/2 in. flat metal.

FIG. 165.—A well-packed box of dressed turkeys packed sides up. Heads and feet are hidden, and the uniformly sized birds add to the attractiveness of the pack. (*U.S. Department of Agriculture.*)

9. Shipping to Market and Storing

Live, dressed, and eviscerated turkeys are shipped to market by different methods, depending upon the distance to the market and other circumstances. Many producers who have few turkeys to sell dispose of them locally. More producers, however, have more birds to dispose of than can be absorbed by the local market and they must be collected at shipping centers and shipped to market in one form or another by parcel post, express, truck, or freight, depending upon circumstances.

It is more economical to dress and eviscerate turkeys in sections of the country where they are raised, and ship the dressed and eviscerated carcasses to market, than to ship live turkeys considerable distances to receiving centers in the larger cities, where dressing and evisceration is done. Dressed birds weigh less and occupy much less space than live birds shipped to market. Shipping eviscerated rather than live birds to market means a considerable saving of transportation charges on heads, feet, and intestines. The trade in quick-frozen eviscerated turkeys seems likely to increase considerably in the future.

FIG. 166.—Eviscerated turkeys "ready to cook," packaged for sale to consumers. (*Institute of American Poultry Industries.*)

Shipping by Parcel Post. This method of shipping is used to a considerable extent by many turkey producers who have regular customers for dressed and eviscerated turkeys. Use ½ to 1 lb. of dry ice per pound of turkey if the parcel-post package will be more than 5 hr. in transit, especially if the weather is not cold.

Shipping by Express. Many producers ship live, dressed, and eviscerated turkeys by express to wholesalers and retailers in the larger cities. If you ship live turkeys by express, sort the turkeys according to grade. Do not attempt to ship live turkeys by express too great distances or the loss in weight will be excessive. The loss in weight during transit should not exceed about 3 per cent. If you ship dressed or eviscerated turkeys by express, be sure that the service is such that the turkeys will arrive in first-class condition.

Shipping by Truck. Shipping live turkeys in crates by truck to packing plants or to distant live markets is a common practice in many parts of the country. Shipping box-packed dressed and eviscerated turkey in refrigerated trucks has increased during recent years.

Shipping by Freight. Enormous numbers of live turkeys are shipped in live-poultry cars from shipping points in producing areas to receiving centers in cities, where the turkeys are dressed and eviscerated. During recent years the practice of shipping box-packed dressed turkeys in refrigerated freight cars has increased and shipping live turkeys by freight has decreased. A major part of this shift in method of marketing is due to the increase in cooperative marketing, where the cooperative organization undertakes the responsibility of dressing the turkeys for producers.

If dressed turkeys are to be shipped to a distant market, they should not be held in the cooling room longer than 3 or 4 days before being shipped. If it is necessary to hold them longer than that in order to fill a car, the dressed turkeys, as soon as they are packed in boxes, should be placed in a sharp freezer kept at a temperature of at least 0°F. and preferrably −10°F. for 24 hr. This gives the dressed birds a hard chilling that enables them to arrive at the receiving market without danger of spoilage. Always lay the boxes on their sides, so that the breasts of the turkeys are upward, with ⅝ in. slats between the boxes to allow the cold air to have easy access to each box while it is in the sharp-freezing room.

The refrigerator car should be iced before being loaded with turkeys, 12 hr. in cold weather and 24 hr. in warm weather, the temperature of the car being reduced at least to the freezing point. Use crushed ice, to which 10 to 15 per cent salt is added, depending upon the weather. Before loading the car, be sure that the bunkers are in good condition and are filled sufficiently and that drain pipes are open and the doors fit tightly. Place the boxes on the floor racks lengthwise of the car, ends of boxes fitting tight, rows of boxes 2 or 3 in. apart, and strips of wood about ½ in. thick crosswise of the car between each tier of boxes. Nail one strip on top of each end of the boxes with fivepenny nails and pack the boxes in the car as tightly as possible, but do not fill the car more than three-fourths of the way to the top.

For each car shipped, an invoice should be sent to the receiver, the invoice containing the following information: date and place of shipment, name and address of receiver, car-seal number, car routing, and number of boxes of each class and grade of turkeys shipped.

Storing Dressed and Eviscerated Turkeys. Turkey production is a seasonal enterprise, most of the poults raised every year being marketed in the late fall and early winter months. Place dressed and eviscerated birds that are not disposed of at the time of the Thanksgiving and Christmas seasons in cold storage, where they are kept frozen until marketed. Quick freezing at temperatures mentioned previously prior to shipping dressed and eviscerated turkeys tends to preserve the natural bloom on the skin of the carcass and also aids in maintaining the flesh in good condition while the birds are in storage. Maintaining a temperature in cold-storage rooms as low as −20 or −30°F. is very desirable.

The data in Table 56 show that cold-storage holdings are lowest during September and October. Some birds go into storage during November and December, but the greatest amount of storing is done during January and February. From March to October, inclusive, cold-storage holdings are progressively reduced. Note particularly the relatively large cold-storage holdings for the 1939 to 1943 period as compared with the 1917 to 1921 period, this marked increase being an index, to some extent, of the expansion of the turkey industry.

TABLE 56. AVERAGE MONTHLY COLD-STORAGE HOLDINGS OF DRESSED TURKEYS PER EACH TWO SUCCESSIVE MONTHS OF THE YEAR FOR DIFFERENT PERIODS OF YEARS
(Thousands of pounds)

Period	January–February	March–April	May–June	July–August	September–October	November–December
1917–1921	6,476	6,620	5,023	3,813	2,291	3,278
1929–1933	11,279	12,210	8,148	5,908	3,958	4,600
1939–1943	47,768	42,369	27,172	20,644	11,134	18,666

When dressed and eviscerated turkeys are removed from cold-storage rooms to be sold, they should be held in refrigerator rooms or cases in retail stores at low temperatures. Defrosting is accomplished by holding the birds overnight in their boxes in the refrigerator room, the process being hastened by removing the lid and laying a clean cloth over the top. If quick defrosting is absolutely necessary, dip the birds in cold water and pat with a clean cloth; never dip the birds in warm or lukewarm water and never rub or wipe the birds.

Birds with reddish-colored parts of the carcass after being removed from cold storage usually indicate improper bleeding at time of killing or freezing of the neck and wings before the interior of the carcass is properly cooled prior to quick freezing.

Preventing Freezer Burn. When dressed poultry is kept in cold storage for some time, the flesh tends to lose moisture unless certain measures are taken to counteract this tendency. The loss of moisture causes pocklike marks to appear on the skin, this condition being called "freezer burn." Maintaining a relative humidity of about 95 per cent in cold-storage rooms, properly lining boxes with parchment paper as described previously, and individually wrapping eviscerated birds will for the most part prevent freezer burn.

Using Frozen-food Lockers. With the rapid expansion of frozen-food locker plants throughout various sections of the country, it is now possible for many families to store dressed and eviscerated turkeys for several months. The same practice is possible in homes through the use of quick-freezing units. Turkey-meat consumption other than during the Thanksgiving and Christmas holidays may be increased through the more widespread use of lockers and home-freezing units.

10. Checking on Factors Affecting Prices

There are several factors affecting the price that producers receive for turkeys, whether in the live, dressed, or eviscerated form, over which individual producers have no control. Nevertheless, it is very important for producers to have some knowledge of these factors that affect prices in order to market turkeys to best advantage. Factors affecting prices over which individual producers have no direct control include regional prices, seasonal prices, number of turkeys raised each year in relation to demand, and consumer preference for turkeys of different sizes. One factor affecting the price of turkeys paid to the producer that is under his control is the grade or quality of turkey he produces.

Recognizing Regional Price Differences. Prices that producers receive for live turkeys vary according to regions of the country, highest prices usually prevailing in the Atlantic and Pacific Coast states. From 1912 to 1914 the average live-turkey farm prices were highest in Nevada, Massachusetts, Connecticut, Rhode Island, New Hampshire, and California and the lowest prices were in Texas, Oklahoma, and Arkansas. During the past 20 years, turkey production has increased considerably in the Pacific Coast states, so that the average prices from 1939 to 1941 in California, Oregon, and Washington were lower than in all the eastern seaboard and some adjoining states, as shown in Fig. 167.

Recognizing Seasonal Price Differences. Turkeys are in greatest demand during the Thanksgiving and Christmas seasons and thus prices are usually higher in November and December than at other times, as has been pointed out previously. Live-turkey prices are usually lowest during June, July, and August. The best time for you to sell your turkeys is when they are in prime market condition, as pointed out earlier in this chapter. October, November, and

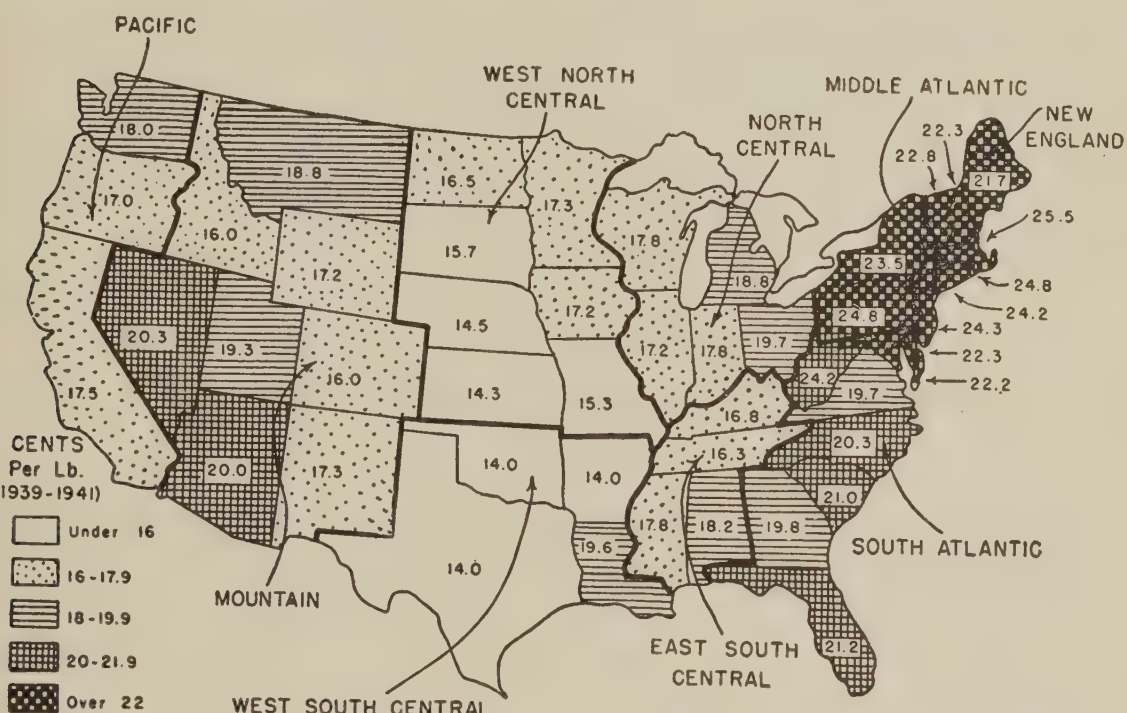


FIG. 167.—Average farm prices of live turkeys, United States, 1939 to 1941. (*J. B. Roberts, Kentucky Experiment Station.*)

December are usually the months when producers in most sections of the country should aim to have their turkeys ready for market. Late-hatched birds may sometimes be sold to good advantage in January, especially if there is a shortage of turkeys to meet market demand. However, if turkeys are held for an anticipated rise in price, the producer should consider the extra feed and other costs of production.

Comparing Production, Demand, and Price. When the demand for turkeys exceeds the supply, prices naturally tend to rise, and when more turkeys are marketed than are demanded for immediate consumption, prices tend to decline and more turkeys are put in storage. Price competition with other meats is an important factor affecting the demand for turkeys, particularly outside of the holiday season.

One of the most important factors affecting the demand for turkeys is the level of consumer income. As the consumer income, or United States factory pay-roll index, increases, the demand and price of turkeys tend to increase, as shown in Fig. 168. Any set of conditions that results in lowering industrial wage scales would undoubtedly have an effect on future demand for turkeys.

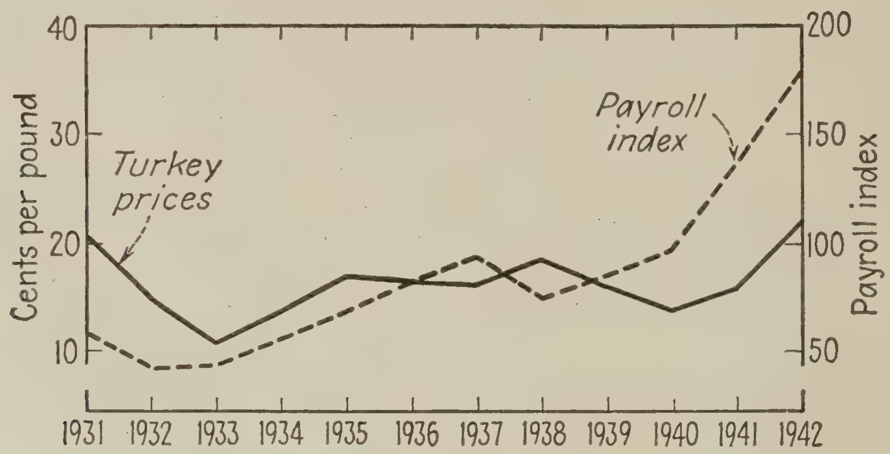


FIG. 168.—Yearly average prices of turkeys at Chicago and factory pay-roll indexes. (*T. L. Canada, Indiana Experiment Station.*)

Comparing Size and Price. Prior to the Second World War there was a marked household consumer preference for relatively small-sized turkeys. Because of the small size of the average American family and the total cost of an individual turkey, most housewives showed a preference for dressed turkeys weighing approximately 9 to 13 lb. Hotels and restaurants preferred large-sized birds. Since hens are considerably smaller than toms, especially in the larger sized varieties, household consumers preferred hens.

The data in Table 57 give the average live weights in pounds of toms, hens, and both sexes at selling time during the marketing seasons of 1937 to and including 1943.

TABLE 57. AVERAGE LIVE WEIGHT, IN POUNDS, OF LIVE TURKEYS AT SELLING TIME, 1937–1943

	1937	1938	1939	1940	1941	1942	1943
Toms	17.6	17.9	17.9	18.2	19.1	19.6	19.4
Hens	11.9	11.9	11.9	12.0	12.7	13.0	12.8
Both sexes	14.8	14.9	14.9	15.1	15.9	16.3	16.1

The data in Table 57 show that there has been a tendency to produce larger sized turkeys. This has probably been due to an increased infusion of Broad-breasted Bronze blood in many breeding flocks of the country and to better management practices in raising turkeys, including the feeding of better diets.

With a little experience, it is fairly simple to distinguish hens from toms. Besides the relatively smaller size of hens, they usually have somewhat plumper breasts and are less angular in body shape. The shanks and feet on females are smaller and the scales on the shanks are somewhat smaller. The head, snood or head appendage, and spurs are smaller in females than in males.

The market price of live toms is nearly always somewhat lower than the market price of live hens. Undoubtedly during peacetime, household consumer preference for relatively small-sized birds will continue. The problem of the turkey breeder, therefore, is to decide upon the approximate size of bird to raise to meet the most popular consumer demand.

Forecasting Prices. Practically every producer in the country would like to know well in advance of each marketing season the price his turkeys will bring. In fact, most producers would like to know in the spring of the year what the price will be in the fall and winter because they would be in a better position to know how many poults to raise. Forecasting prices, however, is practically impossible for producers and is highly speculative even for experienced market men because of the complex problems involved. Since turkey marketing is largely seasonal, there being no continuous supply to furnish a guide in buying and selling, at least as far as each year's crop of young birds is concerned, it is necessary to establish anew each fall the price of young turkeys.

Early in the fall of each year the number of turkeys on farms is known only approximately. Consumer demand as reflected by general business conditions or the factory pay-roll index can only be estimated roughly in advance of the turkey marketing season. The number of turkeys that may be marketed at Thanksgiving is uncertain because of the influence of climate in finishing turkeys, which are not inclined to fatten well in relatively warm weather. The cost of feed in the fall and early winter is sometimes a factor influencing producers' selling tendencies. No consensus is possible concerning the attitude of producers toward selling early or selling late. Furthermore, many turkey buyers use various devices early in the marketing season to keep the farm price relatively low. For these and other reasons, the problem of forecasting prices is a highly speculative matter.

In an effort to stabilize turkey pricing each marketing season, the United States government publishes in advance of marketing time an "Outlook Report," in which various factors are analyzed that will affect prices. You should secure a copy of the "Outlook Report" as soon as it is published, through your county agent, state college of agriculture, a poultry journal, or direct from the government. This "Outlook Report" should help you as much as anything can in deciding when to get your turkeys in prime market condition.

Comparing Prices of Live, Dressed, and Eviscerated Turkeys Many turkey producers are able to sell some of their turkeys alive, some dressed, and some eviscerated but do not know how much to charge for dressed and eviscerated birds in proportion to the live-turkey price. They do not know how much to allow for loss in weight in removing the head, feet and shanks, and the inedible viscera, which usually includes the esophagus, crop, windpipe, lungs, the contents of gizzard, the reproductive organs, and the intestinal tract. The head, feet and shanks, and inedible viscera constitute the offal. The edible viscera include the heart, liver, and gizzard, "giblets" being a popular term for these organs. In addition to the loss in weight due to dressing, if dressed birds are sold, the cost of labor in each case should be added to the price of the live bird. Labor costs differ in various parts of the country and from year to year, so that it is not possible in a book of this kind to give any figures for labor costs in dressing and eviscerating that would be representative.

The loss in weight, or "shrinkage" as it is often called, in dressing and eviscerating is fairly uniform for birds of approximately the same size and in the same market finish. In Table 58 data are given pertaining to the approximate loss in weight due to dressing and eviscerating young males and females, fasted 12 to 18 hr. before being killed at 28 weeks of age, in four different varieties. These live birds were in good market condition although some turkey producers have been known to have had less shrinkage than that reported in Table 58 because they killed their turkeys at 30 and in some cases 32 weeks of age. The data in Table 58, however, may be taken to apply to most birds of similar sizes that are in good market condition.

Keep in mind that the percentages given in Table 58 are based on the fasted weight of live birds. All live turkeys should be fasted at least 12 hr. before being killed. A high proportion of the turkeys sold alive are paid for on the basis of fasted weight because the price is often based on the weight of the turkeys at the receiving or shipping center, usually after the birds were several hours in transit.

TABLE 58. APPROXIMATE PERCENTAGES OF SHRINKAGE DUE TO DRESSING AND EVISCERATING AND APPROXIMATE PERCENTAGES OF DRESSED TO LIVE WEIGHT AND OF EVISCERATED TO DRESSED AND LIVE WEIGHT, RESPECTIVELY, IN TURKEYS KILLED AT 28 WEEKS OF AGE

(Adapted from data of H. M. Harshaw, W. L. Kellogg, R. R. Rector, and S. J. Marsden, U.S. Department of Agriculture, 1943)

Variety and sex	Fasted live weight, pounds	Per cent blood and feathers of live weight	Per cent dressed weight of live weight	Per cent offal of dressed weight	Per cent eviscer-ated weight of dressed weight	Per cent eviscer-ated weight of live weight
Broad-breasted Bronze:						
Males	24.0	9.5	90.5	17.5	82.5	74.7
Females	15.5	8.5	91.5	16.0	84.0	76.9
Standardbred Bronze:						
Males	20.0	10.0	90.0	19.0	81.0	72.9
Females	12.5	9.0	91.0	18.0	82.0	74.6
White Holland:						
Males	18.5	11.0	89.0	19.0	81.0	72.1
Females	11.0	12.0	88.0	18.0	82.0	72.2
Beltsville Small-type White:						
Males	15.0	11.0	89.0	19.0	81.5	72.5
Females	9.0	12.0	88.0	18.0	82.0	72.2

The method of determining the price per pound for dressed and eviscerated birds, not including labor charges, in relation to the price per pound for live turkeys is quite simple. Suppose you have a live turkey whose fasted weight was 20 lb., by consulting Table 58 you see that the dressed weight is approximately 90 per cent of the live weight; the dressed weight, therefore, is 18 lb. You see also that the eviscerated weight is approximately 72.9 per cent of the live weight; the eviscerated weight, therefore is 14.6 lb. If the live turkey price is 30 cents per pound, your 20-lb. live fasted turkey is worth $6. To determine the price per pound for the same bird dressed, divide $6 by 18 and you get 33.3 cents. You can either add so much per pound for dressing or charge a flat price per bird to give you the proper amount to charge for the dressed bird. To determine the price per pound for the same bird eviscerated, divide $6 by 14.6 and you get 41.1 cents. You can either add so much per pound or per bird for eviscerating to give you the total amount you should charge for the eviscerated bird. If you pack your dressed and eviscerated birds in cartons or bags, the cost of these should be included, plus any costs involved in delivering or mailing.

If the live-turkey price is based on birds not fasted, you should keep in mind that fasting causes a shrinkage of about 3.25 per cent, so that your dressed and eviscerated prices must be figured accordingly.

Keep in mind that the figures in Table 58 are approximations and apply to turkeys in good market finish at time of slaughter. Birds that are poorly finished when slaughtered will have relatively greater shrinkage in dressing and eviscerating than indicated in Table 58 for the simple reason that they have less flesh in proportion to total body weight than birds in good market finish and especially than birds in prime market condition. Turkeys killed at 30 or 32 weeks of age, if in prime market condition at killing time, should show relatively less shrinkage in dressing and eviscerating than indicated for the birds killed at 28 weeks in Table 58.

11. Using Turkey Meat

Every housewife who purchases a turkey naturally wants to get a bird that will provide the highest possible amount of edible meat in proportion to the total weight of the bird, whether it is dressed or eviscerated. The breast and the legs contribute from about 60 to 70 per cent of the total edible meat in well-fattened turkeys, as shown in Table 59. In this table are given the percentages of breast muscle, leg muscle, remaining edible meat, and total edible meat in dressed turkeys and the percentage breast and leg meat of the total edible meat. Data are given for four varieties, all birds having been killed at 28 weeks of age.

The data in Table 59 show the importance of breeding turkeys for the development of broad breasts and plump legs or drumsticks. The percentage of breast and leg meat of the total edible meat is higher in males than in females, although in most cases the percentage of breast meat of the dressed weight is higher in females than in males. Females killed at the same age as males are usually fatter than males and, therefore, have a higher percentage of edible meat other than breast and legs in proportion to dressed weight than males.

TABLE 59. APPROXIMATE PERCENTAGES OF BREAST MUSCLE, LEG MUSCLE, OTHER EDIBLE MEAT, AND TOTAL EDIBLE MEAT IN DRESSED TURKEYS AND THE PERCENTAGE BREAST AND LEG MUSCLE OF TOTAL EDIBLE MEAT IN TURKEYS KILLED AT 28 WEEKS

(Adapted from data of H. M. Harshaw, W. L. Kellogg, R. R. Rector, and S. J. Marsden, U.S. Department of Agriculture, 1943)

Variety and sex	Dressed weight, pounds	Per cent breast muscle of dressed weight	Per cent leg muscle of dressed weight	Per cent other edible meat of dressed weight	Per cent total edible meat of dressed weight	Per cent breast and leg meat of total edible meat
Broad-breasted Bronze:						
Males	21.7	22.0	20.5	18.0	60.5	70.2
Females	14.2	23.0	20.0	21.5	64.5	66.7
Standardbred Bronze:						
Males	18.0	18.0	19.5	21.0	58.5	64.1
Females	11.4	18.5	19.0	24.0	61.5	61.1
White Holland:						
Males	16.5	18.0	19.0	22.0	59.0	62.7
Females	9.7	18.5	18.5	24.5	61.5	60.2
Beltsville Small-type White:						
Males	13.4	20.0	18.5	22.0	60.5	63.6
Females	7.9	18.5	18.0	25.0	61.5	59.4

TABLE 60. APPROXIMATE WEIGHT, IN POUNDS, OF DRESSED AND EVISCERATED TURKEYS AND OF EDIBLE MEAT ACCORDING TO LIVE WEIGHT IN FOUR VARIETIES, THE TURKEYS HAVING BEEN KILLED AT 28 WEEKS OF AGE

Variety and sex	Live weight	Dressed weight	Eviscerated weight	Edible meat
Broad-breasted Bronze:				
Males	24.0	21.7	17.9	13.1
Females	15.5	14.2	11.9	9.2
Standardbred Bronze:				
Males	20.0	18.0	14.6	10.5
Females	12.5	11.4	9.4	7.0
White Holland:				
Males	18.5	16.5	13.4	9.7
Females	11.0	9.7	8.0	6.0
Beltsville Small-type White:				
Males	15.0	13.4	10.9	8.1
Females	9.0	7.9	6.5	4.9

Estimating Edible Meat in Relation to Live Weight. Many consumers would like to know how much edible meat can be obtained from a live, dressed, or eviscerated turkey of a given weight. From data given in Tables 58 and 59, it is possible to estimate the dressed and eviscerated weights and the amount of edible meat in turkeys according to the live weight. It should be understood, of course, that turkeys in poor condition at slaughtering time will yield less edible meat in proportion to live weight than turkeys in prime market condition at slaughtering time. The estimated weights given in Table 60 are based on turkeys in good market condition when they were slaughtered at 28 weeks of age.

The percentage of edible meat of the live weight is higher in females than in males, as the following figures show.

Broad-breasted Bronze		Standardbred Bronze		White Holland		Beltsville Small-type White	
Males	Females	Males	Females	Males	Females	Males	Females
54.6	59.4	52.5	56.0	52.4	54.5	54.0	54.4

From the data in Table 60, it is possible to determine the approximate size of a live, dressed, or eviscerated bird to order for a dinner depending upon the number of persons being served and the portion of eviscerated turkey or edible meat to be served each person.

The U.S. Department of Agriculture renders a valuable service to the turkey industry by publishing data on turkey production and per capita consumption annually. In Table 61 are given the number of millions of pounds of dressed turkeys produced annually from 1930 to 1944, inclusive, the cold-storage stocks of dressed turkeys on hand at the beginning and the end of each year, the annual imports, the number of millions of pounds consumed, and the per capita consumption.

The data in Table 61 indicate the relatively steady expansion of the turkey industry during the 15-year period covered, the production during 1942, 1943, and 1944 having been very large partly because of the tremendous demands of the armed forces overseas during the Second World War. Per capita consumption has also shown a steady increase, due in part to higher industrial pay-roll income and the more extensive use of turkey meat at other times of the year than the traditional Thanksgiving and Christmas seasons.

TABLE 61. DRESSED TURKEY PRODUCTION AND CONSUMPTION, 1930–1944

Year	Production, millions of pounds	Cold storage stocks at beginning of year, millions of pounds	Imports, millions of pounds	Cold storage stocks at end of year, millions of pounds	Consumption	
					Total, millions of pounds	Per capita, pounds
1930	216	10	1	5	222	1.80
1931	214	5	5	10	214	1.70
1932	264	10	1	15	260	2.10
1933	298	15	*	16	297	2.40
1934	284	16	*	19	281	2.20
1935	267	19	*	17	269	2.10
1936	361	17	1	35	344	2.70
1937	346	35	*	26	355	2.70
1938	355	26	*	23	358	2.70
1939	422	23	*	52	393	3.00
1940	482	52	*	61	473	3.56
1941	468	61	1	50	472	3.56
1942	496	50	..	36	488	3.69†
1943	466	36	..	37	439	3.40†
1944	547	37	..	72	431	3.30†

* Less than 500,000 lb.

† Civilian per capita consumption only, large numbers of dressed turkeys being sent overseas to the armed forces during the Second World War.

Preparing Turkey for the Table. The traditional form of serving turkey is as roast turkey stuffed with dressing and gravy made of the giblets. There are few dishes that grace the dinner table as effectively as a plump roast turkey. The trade in eviscerated turkey ready for oven has steadily increased and will probably continue.

Since large toms are sometimes difficult to dispose of at prices comparable with smaller sized birds, some dealers sell half a turkey to a customer with the idea of increasing the sales of large toms.

Frozen roasted turkey is popular with some customers.

Frozen boneless turkey meat is also available in some markets.

Making Turkey Roll. Probably the finest way of all to serve turkey is in the form of a turkey roll. Carving is simplified because the bones are removed and the meat is enclosed in the skin. Boning the eviscerated carcass takes time and requires skill to do it properly, but the finished product is worth all the trouble. Pull the tendons and cut off the wings at the second joint. Slit the skin from the middle of the neck, over the keel, to the vent and pull the skin off of the carcass in one piece. Remove the meat from the carcass and, after placing alternate layers of white and dark meat on the outstretched skin, roll the skin around the contents, keeping the edges of the skin at the ends

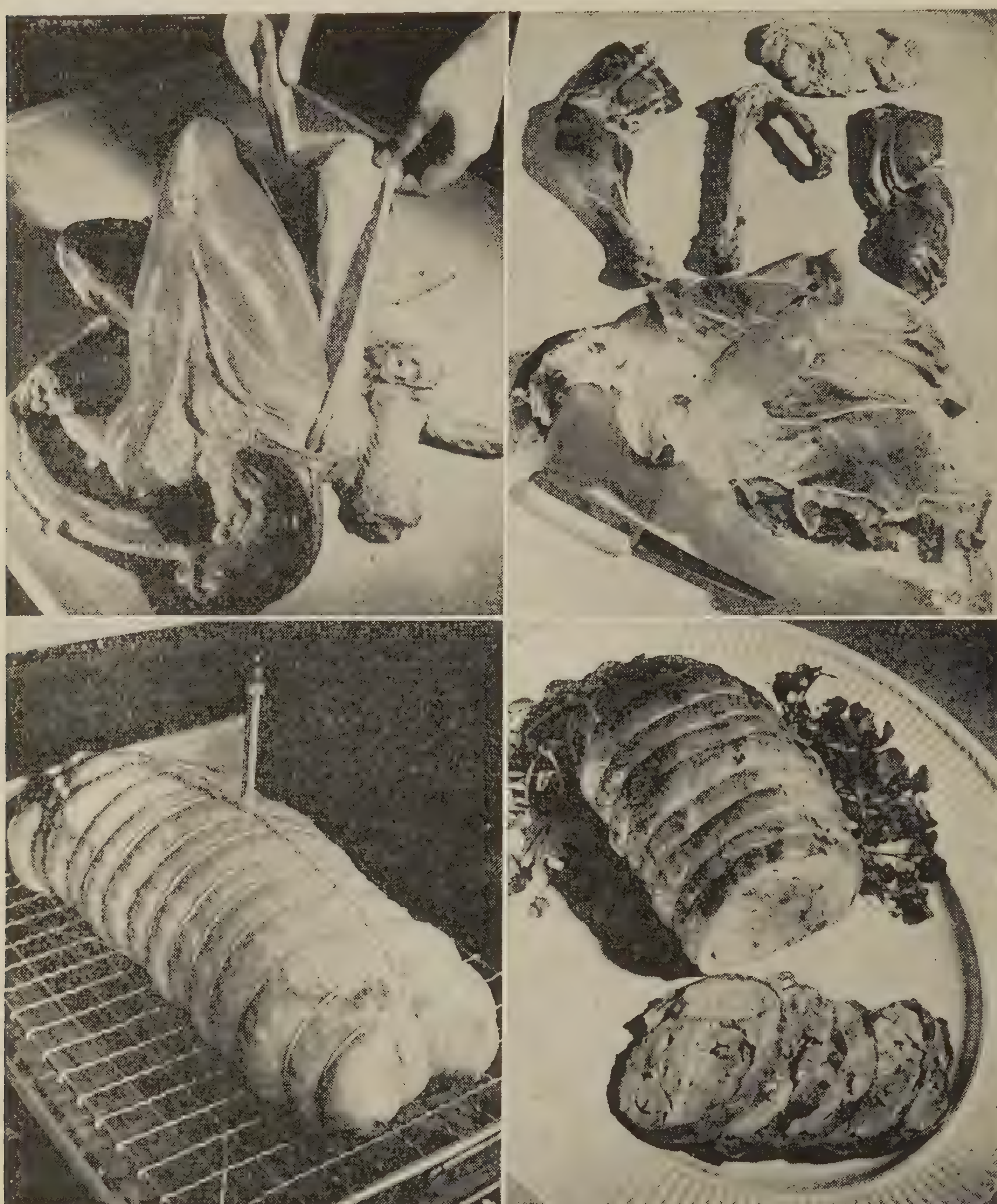


FIG. 169.—Showing method of making turkey roll. (*Mrs. Kathryn B. Niles, photo by U.S. Egg and Poultry Magazine.*)

turned in so that the completed roll forms a neat appearance. If desired, dressing may be added before rolling.

Preparing Smoked Turkey. The possibility of increasing the consumption of turkey meat is enhanced by making smoked turkey available to consumers. This delicacy is prepared by curing eviscerated turkeys or turkey roll in a brine solution and then smoking the cured turkey meat or by curing the eviscerated carcasses or turkey roll with specially prepared mixtures having a smoke flavor. Remove the tendons of eviscerated turkeys before treatment. The body temperature of the birds should be about 38°F. to 40°F. before being placed in the brine.

For 100 lb. of eviscerated turkeys, the U.S. Department of Agriculture recommends a brine-curing mixture of 25 lb. of salt, 12.5 lb. of brown sugar, 12.5 oz. of saltpeter, and 18 gal. of water. The temperature of the brine should be about 38°F. Keep the turkeys in the brine 1.5 days per pound of eviscerated turkey, small-sized turkeys being cured for about 14 days and large-sized birds for about 21 days. About every 4 days remove the turkeys from the brine and repack them in order to ensure more thorough curing. After being properly cured, the birds are washed in warm water, hung up to dry, and smoked for 16 hr. at a temperature of 140°F. Use hardwood, such as hickory or green applewood, to produce a smoldering fire. When using the specially prepared smoke mixtures, follow the directions of the manufacturers.

Preparing Fried Turkey. Young turkey poults weighing about 6 lb. each are delicious fried, but, since chicken broiler and fryer production has increased to large proportions, it seems doubtful if public demand for fried turkey will assume important proportions. Moreover, since the initial cost of turkey hatching eggs and poults is so much higher than the initial cost of chicken hatching eggs and baby chicks, it would probably not be profitable to sell poults for frying unless a justified price could be secured.

Preparing Barbecued Turkey. This is a delicacy that requires considerable care in its preparation but is particularly well suited for certain occasions.

Canning Turkey. The canning of turkey meat has gained in importance during recent years, and during the Second World War considerable quantities of canned turkey were sent to the armed forces. Canned boneless turkey is a favorite dish at all times. Many turkey producers can their breeding stock after the hatching season is over. In some cases the white meat and dark meat are canned separately.

Preparing Turkey Paste. This is a highly prized specialized product usually prepared from smoked turkey and served as a canapé or relish.

12. Selling Feathers and Utilizing Offal

The principal by-products of the turkey industry include feathers and all other inedible parts of the live bird after it is killed and eviscerated. These by-products have distinctive values, and every effort should be made to utilize them to the fullest possible extent.

Selling Feathers. Certain kinds of turkey feathers are used for a variety of purposes, such as in mattresses, for the manufacture of plastics, for the production of liquid adhesives, trimming hats, and making feather dusters and artificial flowers. Many turkey growers increase the income from their flock materially by carefully sorting the feathers at dressing time and selling them sorted. Feathers from turkeys dry plucked are worth more than feathers from turkeys plucked by other methods. Wet feathers from semiscalded birds have to be cleaned, dried, and sorted. A solution made up of 1 pt. of hydrochloric acid, 15 lb. sodium chloride, and 30 gal. of water is used for treating wet feathers before they are dried and sorted. Feathers from dry-plucked birds must be thoroughly dried before being used, drying usually being done in specially constructed driers, which sort the feathers if necessary.

If you want to secure the best price for your feathers, have three barrels or boxes handy for the pluckers to sort the quill feathers and a bag for the body feathers. Put the tail feathers in one barrel, the primary feathers in another barrel, and the secondaries in another barrel. Put the body feathers in the burlap or cotton bag. Remove the feathers from the barrels or boxes at frequent intervals and put them in bags to dry as much as possible before being sold; when bagging them be careful not to break the quills. White feathers are usually preferred by feather buyers. Feathers account for about 5 to 6 per cent of the live weight of turkeys and bring a good price if in good condition and properly sorted.

Utilizing Offal. The offal of live birds includes the blood, heads, feet and shanks, and inedible viscera. All these by-products have definite values and should be saved when sufficient quantities can be secured to justify the expense involved in processing them for use. Blood may be processed as blood meal or for fertilizer. The rest of the offal is also processed into fertilizer or dog or fox food. The inedible viscera could be processed into meat scrap for feeding poultry. The shanks and feet could be processed into gelatin.

SUMMARY

1. Do not market any of your young toms and hens until you have selected the best of them to save for breeding purposes.

2. Choose the most direct marketing channel possible because the greater the number of marketing agencies through which your birds pass in reaching the consumer, usually the lower the proportion of the consumers' dollar you receive.

3. In order to obtain the highest possible price for your turkeys, be sure that they are in prime market condition by examining them for breast fleshing, thigh fleshing, fattened finish, and absence of pinfeathers.

4. (*a*) To determine breast fleshing, use both hands as described and illustrated in this chapter; (*b*) at the same time feel the thighs for plumpness; (*c*) use the skin-fold method of determining fattened finish; (*d*) for absence of pinfeathers, look on the underside of the wing, between the feather tracts, and on the lower thigh.

5. Study the specifications for tentative U.S. Grades Nos. 1 and 2 in live turkeys and sell your turkeys on a graded basis, if you sell live rather than dressed birds.

6. How turkeys are killed and dressed affects their grade and price as well as consumer appeal. Do not bruise the birds when catching them; withhold feed before killing; do not tear the skin; remove blood from head and feces from vent; scrub the feet.

7. Cool dressed birds promptly, down to about 32°F. inside the carcass within 8 hr.

8. Wrap the heads of dressed turkeys to improve their appearance.

9. Keep in mind that the demand for eviscerated turkeys, with tendons removed, will increase in the future.

10. Practice judging dressed turkeys and become familiar with the specifications for the classes and grade proposed by the United States government.

11. Pack dressed turkeys according to size and grade.

12. Be sure dressed turkeys are kept properly cooled in transit.

13. Prevent "freezer burn" in dressed turkeys placed in cold storage by lining boxes with parchment paper and maintaining 95 per cent humidity in cold-storage rooms.

14. Quick-freezing eviscerated turkeys maintains natural bloom and keeps flesh in good condition.

15. Study all factors affecting price of live, dressed, and eviscerated turkeys.

8. Making a Success of the Turkey Enterprise

YOU could sell 1,000 poults secured from the same breeding flock to each of two different turkey growers living side by side with identical facilities for raising their poults and the chances are they would get quite different results. For the most part the differences in results secured would be due to differences in managerial ability.

Raising and marketing turkeys successfully requires of the turkey grower a liking for turkeys, a knowledge of their habits, careful attention to details, and sound judgment concerning methods of rearing, feeding, buying feed, keeping records, controlling disease, and selling the turkeys to best advantage—alive, dressed, or eviscerated. Making a success of the turkey enterprise includes the following activities:

1. Recognizing the Importance of Turkey Industry
2. Comparing Cost Factors in a Turkey Enterprise
3. Producing Hatching Eggs Economically
4. Hatching Poults Economically
5. Raising Turkeys Economically

1. Recognizing the Importance of Turkey Industry

During the past several years the turkey industry has increased in importance, as indicated by the figures on per capita consumption of turkey meat given in Chap. 7. Turkeys are raised on many farms of the country as a side line to other farming occupations and thousands of commercial flocks are raised annually by turkey growers who depend on the turkey crop for their main source of income.

There are over 6 million farms in the United States, and according to the United States Census there were at least 438,000 farms on which turkeys were raised in 1940. In spite of the fact that the turkey industry has increased in importance, there were only about one-half as many farms on which turkeys were kept in 1940 as in 1910. The percentage of all farms reporting turkeys on hand and raised for the following years was 1910, 13.7 per cent; 1920, 10.4 per cent; 1935, 9.9 per cent; and 1940, 7.3 per cent. The fact that during the past few years more turkeys were raised in the country as a whole but fewer farmers reported raising turkeys means that larger flocks per farm have been raised, including an increase in the relative number of large commercial flocks.

The data in Table 62 give the average number of turkeys raised annually in two successive 5-year periods and during 1941, 1942,

TABLE 62. AVERAGE NUMBER OF TURKEYS RAISED ANNUALLY IN TWO SUCCESSIVE 5-YEAR PERIODS AND DURING 1941, 1942, 1943, AND 1944, BY STATES AND GEOGRAPHICAL DIVISIONS, IN THOUSANDS
(Bureau of Agricultural Economics, U.S. Department of Agriculture)

State and division	Average, 1931–1935	Average, 1936–1940	1941	1942	1943	1944
	Thousands					
Maine	40	46	44	43	43	43
N.H.	30	51	65	69	64	71
Vt.	46	113	155	145	142	159
Mass.	149	209	224	240	216	227
R.I.	22	22	22	25	26	30
Conn.	62	93	95	114	117	146
N.Y.	250	352	420	420	335	428
N.J.	96	128	120	133	160	192
Pa.	527	678	927	1,020	1,071	1,285
North Atlantic	1,122	1,692	2,072	2,219	2,225	2,581
Ohio	638	748	815	896	851	979
Ind.	348	383	358	394	453	612
Ill.	270	463	630	662	609	828
Mich.	431	467	472	481	519	612
Wis.	318	373	462	504	554	692
East North Central	2,005	2,434	2,737	2,937	2,986	3,723
Minn.	1,948	2,461	3,207	3,207	2,983	3,341
Iowa	704	1,505	1,782	1,729	1,867	2,147
Mo.	620	1,251	1,544	1,359	1,332	1,532
N. Dak.	1,542	1,479	1,303	1,212	945	992
S. Dak.	701	1,020	1,250	950	551	468
Nebr.	489	781	1,200	1,200	1,140	1,208
Kans.	476	987	1,157	1,064	953	948
West North Central	6,480	9,485	11,443	10,721	9,776	10,636
Del.	108	111	121	113	102	107
Md.	392	405	405	405	364	400
Va.	652	765	805	902	857	986
W. Va.	288	226	225	270	235	254
N. C.	252	230	239	258	241	277
S. C.	143	147	142	155	256	307
Ga.	128	119	117	140	168	168
Fla.	127	117	115	115	120	118
South Atlantic	2,090	2,120	2,169	2,368	2,343	2,617
Ky.	554	350	310	310	254	267
Tenn.	248	207	213	196	200	190
Ala.	201	127	155	170	170	144
Miss.	124	121	139	143	129	111
Ark.	90	111	131	140	126	132
La.	62	65	66	73	77	69
Okla.	1,030	1,511	1,275	1,122	954	954
Tex.	3,814	4,134	3,651	3,724	3,724	3,761
South Central	6,123	6,627	5,940	5,878	5,634	5,628
Mont.	391	285	276	276	246	253
Idaho	286	232	248	273	218	272
Wyo.	272	252	173	176	167	167
Colo.	572	827	846	888	861	861
N. Mex.	128	73	52	55	55	52
Ariz.	117	81	61	81	89	93
Utah	363	707	857	1,166	1,341	1,743
Nev.	76	61	38	25	35	40
Wash.	263	568	996	1,096	1,206	1,387
Oreg.	833	1,467	1,726	1,812	2,034	2,084
Calif.	1,860	2,776	3,527	3,139	3,704	4,260
Western	5,161	7,330	8,800	8,987	10,006	11,212
U.S.	23,081	29,687	33,161	33,110	32,970	36,397

1943, and 1944. Over 55 per cent more turkeys were raised in 1944 than the average number raised during the 5-year period 1931 to 1935.

FIG. 170.—Throughout the United States several thousand members of the Future Farmers of America (F.F.A.) carry on turkey-raising projects every year, many of them making an outstanding success. Elmer Fish, near Redding, Calif., started his first F.F.A. project in 1937 and up to and including 1944 raised over 17,000 turkeys. (*California Future Farmer Magazine.*)

The rank of the first ten states in numbers of turkeys raised per 5-year period and per year is as follows:

1931–1935	1936–1940	1941	1942	1943	1944
Tex.	Tex.	Tex.	Tex.	Tex.	Calif.
Minn.	Calif.	Calif.	Minn.	Calif.	Tex.
Calif.	Minn.	Minn.	Calif.	Minn.	Minn.
N. Dak.	Okla.	Iowa	Oreg.	Oreg.	Iowa
Okla.	Iowa	Oreg.	Iowa	Iowa	Oreg.
Oreg.	N. Dak.	Mo.	Mo.	Utah	Utah
Iowa	Oreg.	N. Dak.	N. Dak.	Mo.	Mo.
S. Dak.	Mo.	Okla.	Nebr.	Wash.	Wash.
Va.	S. Dak.	S. Dak.	Utah	Nebr.	Pa.
Ohio	Kans.	Nebr.	Okla.	Pa.	Nebr.

The number of turkeys produced annually and the gross income from the turkey industry each year from 1929 to 1943, together with other pertinent data, are given in Table 63. The turkey industry in the United States is indeed big business.

TABLE 63. TURKEYS: FARM PRODUCTION, DISPOSITION, AND INCOME, 1929–1943
(Bureau of Agricultural Economics, U.S. Department of Agriculture)

Year	Number produced*	Number sold	Number consumed†	Production, pounds	Value of turkeys produced	Cash income (sales)	Value of turkeys consumed†	Gross income‡
	Thousands				Thousands			
1929	18,136	16,023	1,685	239,395	$ 61,579	$ 54,340	$5,687	$ 60,027
1930	17,052	15,999	1,704	228,497	49,475	46,323	4,901	51,224
1931	17,923	15,746	1,549	243,753	47,297	41,590	4,025	45,615
1932	21,964	19,393	1,665	303,103	42,950	37,946	3,251	41,197
1933	22,813	21,733	1,623	319,382	37,584	35,788	2,624	38,412
1934	21,310	20,615	1,505	300,471	43,622	42,098	2,984	45,082
1935	20,487	18,827	1,428	297,062	57,002	52,412	3,812	56,224
1936	27,642	25,530	1,485	406,337	66,663	61,533	3,437	64,970
1937	25,391	24,227	1,425	375,787	66,213	63,406	3,527	66,933
1938	26,547	24,861	1,291	395,550	70,477	66,192	3,261	69,453
1939	33,201	29,821	1,297	494,695	78,510	70,715	2,909	73,624
1940	33,775	33,796	1,296	508,788	78,230	78,376	2,862	81,238
1941	33,189	31,511	1,220	527,705	104,150	98,752	3,630	102,382
1942	32,659	32,441	1,137	530,300	145,279	144,699	4,749	149,448
1943	32,565	30,569	1,180	526,798	171,679	160,938	5,867	166,805

* Turkeys sold, plus consumed in households of farm producers, plus or minus change in inventory.
† Consumed in households of farm producers.
‡ Value of sales, plus consumed in households of producers.

2. Comparing Cost Factors in a Turkey Enterprise

All turkey enterprises, small as well as large ones, involve certain cost factors that should always be taken into consideration in determining net returns. Even a small project in which 50 poults are to be raised involves cost factors that are often overlooked by the person raising the poults. In a commercial enterprise from which a turkey grower expects to make a living, all cost factors must be considered or the turkey grower may actually have lost money, although he believes he made a profit.

The cost factors in a turkey enterprise may be grouped as follows: (1) capital investment, new houses, new sun porches, and perma-

Fig. 171.—Herding turkeys on the open range. Note the wagon, which provides sleeping quarters for the attendant, and the roosts on wheels. (*M. O. North, Wyoming Agricultural College.*)

Fig. 172.—Confinement rearing, with sun porch, on Warren D. Johnson's farm in Pennsylvania. (*H. H. Kauffman, Pennsylvania Extension Service.*)

nent equipment; (2) overhead costs; (3) general expenses; (4) hatching eggs, poults, or breeding stock purchased; (5) mortality; (6) use of land, buildings, and equipment; (7) feed; (8) labor, including operator's labor and hired labor, if any.

You can charge up the cost of new houses, sun porches, and permanent equipment installed by charging on your annual statement so

FIG. 173.—Minnesota is one of the leading turkey-producing states in the country, there being many commercial flocks of several thousand turkeys raised each year. (*W. A. Billings, Minnesota Agricultural College.*)

FIG. 174.—Roosts, feeders, and bluegrass range on a Clark County Kentucky farm. (*W. M. Insko, Jr., Kentucky Experiment Station.*)

much interest on the investment. The overhead costs include your taxes, insurance, and interest on investment. Your general expenses include fuel for brooding, electric current, gas for the truck or automobile, litter, disinfectants, and other similar items. You should naturally include the cost of hatching eggs, poults, and breeding stock purchased and you should also keep track of mortality. For the use of land, buildings, and equipment, make an annual charge to provide for rent of the land and depreciation of buildings and equipment. Depreciation charges of 5 per cent may be made on permanent buildings, 10 per cent on portable houses, and 10 to 25 per cent on equipment, depending on its durability.

Feed is the most important cost factor in raising turkeys. You should buy feed as wisely as possible and keep an accurate record of the amount of feed consumed by turkeys, so that when you weigh your birds at marketing time you can determine the number of pounds of feed consumed per pound of turkey produced. That's a pretty good index of your managerial ability, especially if you had a good strain of poults and no serious mortality.

Keep a record of your time spent raising the flock and the cost of hired labor. The daily routine of work in tending the flock should be carefully planned not only to secure best results but also to utilize your time as efficiently as possible. Labor income is the pay a turkey grower receives for his labor and management, after deducting all expenses and interest on the capital invested in the enterprise. In other words, labor income represents the amount of money that the turkey grower receives for conducting the turkey enterprise.

The net profit obtained from a turkey enterprise is the amount of money left over after all costs, including labor costs, are deducted from the total receipts.

3. Producing Hatching Eggs Economically

More hatching eggs per hen at less cost per dozen should be your goal as a turkey breeder. The business of producing hatching eggs has increased in importance during the past few years. One factor that has been responsible for this is the demand on the part of hatcheries in northern sections of the country for turkey hatching eggs early in the season. If you are a turkey breeder you are naturally interested in gaining information that will enable you to produce hatching eggs more economically. From the discussion that follows you will learn that three of the most important items of cost in producing hatching eggs are: (1) feed; (2) depreciation of breeding stock; and (3) labor.

One reason why feed cost per hatching egg produced is so high in many flocks is because of the relatively low egg production per hen. Two factors responsible for the relatively high cost of breeding-stock depreciation are mortality and the decreased value of the breeders at the end of the breeding season. Labor cost is affected by the managerial efficiency of the operator and by the relative size of the breeding flock.

One of the first studies made to determine the cost of producing hatching eggs was made in Oregon in 1934 on 45 representative breeding flocks having an average of 144 hens and 15 tons per flock, the average period that the birds were in the breeding flock being 6.4 months. The average price of grain was $23 per ton and mash $38 per ton. Labor was valued at 22 cents per hour. The average value of the hens at the beginning of the breeding season was $2.81 and at the end of the breeding season $1.89; for toms the figures were $6.88 and $3.09. Table 64 gives data on the items of cost in producing hatching eggs.

TABLE 64. COST OF PRODUCING TURKEY HATCHING EGGS ON 45 FARMS IN OREGON IN 1934
(A. S. Burrier, F. L. Knowlton, and H. E. Selby, Oregon Experiment Station, 1934)

Item	Cost per farm	Cost per hen	Cost per hatching egg, cents	Per cent of total cost
Feed	$254	$1.76	5.3	38
Depreciation of breeding flock	197	1.36	4.1	30
Labor	130	0.91	2.7	20
Use of land, buildings, and equipment	53	0.36	1.1	8
Interest on value of flock (5 per cent)	13	0.09	0.3	2
Taxes	7	0.05	0.1	1
Miscellaneous	7	0.05	0.1	1
Total gross cost	$661	$4.58	13.7	100
Credit for cull eggs	6	0.04	0.1	1
Total net cost	$655	$4.54	13.6	99

The average capital investment required for the turkey breeding flock on these 45 Oregon farms was $4.15 per bird, including value of the land used, buildings, and equipment and the average investment in feed, supplies, and the breeding flock. The average value of buildings and equipment was $122 per farm. Feed consumed amounted to 56.5 lb. of mash and 52.2 lb. of grain or 108.7 lb. of feed per bird. Labor amounted to 4.1 hr. per bird. The hens laid an average of 37 eggs each. The average cost of producing hatching eggs was 13.6 cents per egg but varied on individual farms from less than 10 cents to over 30 cents per egg. It was found that two of the most important factors affecting the cost of producing hatching eggs were the average number of eggs per hen, as shown in Fig. 175, and the size of the breeding flock.

An economic study of the cost of producing hatching eggs in 1942 was made in the three principal Washington State turkey-producing areas, Clark County, Island County, and the Yakima Valley. The study included 61 flocks, averaging 329 hens and 36 toms per flock, and the breeding season averaged 139 days per flock. Feed consumption averaged 72.7 lb. per bird and egg production averaged 40.8 eggs per hen. The average value of all hens was $4.78 and that of all toms $7.38 at the beginning of the breeding season.

"Interest was computed at 5 per cent on the average inventory and at 6 per cent on operating capital. An average depreciation rate of 10 per cent was used for turkey buildings and laying nests, whereas 20 per cent was used for other turkey equipment such as fences, water systems, and the like. Cost of labor was based on the

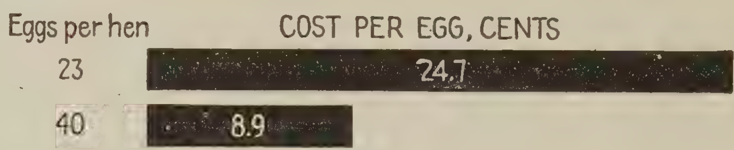


FIG. 175.—The higher the average egg production per hen in a flock, the lower the cost of producing hatching eggs. In the case of Oregon breeding flocks in 1934, an increase of 17 eggs per hen resulted in a decrease of 15.8 cents per egg in the cost of production. (*Graph made from data of A. S. Burrier, F. L. Knowlton, and H. E. Selby, Oregon Experiment Station.*)

rate per hour paid by the breeders in each area of the state. Average rates paid per hour were $1.02 in Clark County, 54.8 cents in Island County, and 55.1 cents in Yakima Valley. Operating and miscellaneous expenses included truck and auto costs, rents, electricity, and expendable materials, such as rope, wire, and breeding saddles." (See authors cited in Table 65.)

The data in Table 65 give the distribution of costs in producing hatching eggs on the 61 turkey breeding farms in Washington in 1942.

TABLE 65. COST OF PRODUCING HATCHING EGGS ON 61 FARMS IN WASHINGTON IN 1942
(C. N. Berryman and M. T. Buchanan, Washington Experiment Station, 1944)

Item	Cost per 100 breeder birds	Per cent of total cost
Feed	$203.40	33.6
Depreciation and death loss on breeders	185.00	30.6
Labor	159.54	26.4
Use of buildings and equipment	15.50	2.6
Interest charge on breeders	6.51	1.1
Interest on buildings and equipment	5.50	0.9
Interest on operating capital	4.85	0.8
Operating and miscellaneous costs	25.00	4.0
Total cost	$605.30	100.0

The data in Table 65 show that in Washington, as in Oregon, the three most important cost factors in producing turkey hatching eggs were feed, depreciation of the breeding stock, and labor.

The 61 Washington breeding flocks varied considerably in size, making it possible to compare the average man-hours of labor required

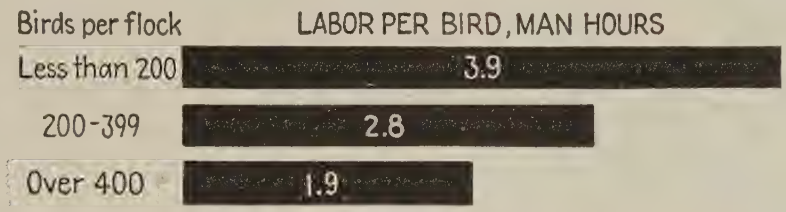


FIG. 176*A*.—Fewer man-labor hours per bird are required in large breeding flocks than in small ones. (*Graph made from data of C. N. Berryman and M. T. Buchanan, Washington Experiment Station.*)

FIG. 176*B*.—Laborsaving equipment. Left, a feed cart saves time and labor in "packing" feed from the feed room to the breeding pens and rearing yards. (*U.S. Department of Agriculture.*) Right, a rubber-tired cart for gathering eggs. (*Manwaring Farms, Indiana.*)

per bird with flocks of different sizes. The data in Fig. 176*A* show that fewer man-hours of labor per bird were required for the largest sized flocks than for smaller sized flocks.

Other factors affecting costs of producing eggs according to size of flock are considered in Table 66.

TABLE 66. HATCHING EGGS PRODUCED PER HEN IN WASHINGTON IN 1942, ACCORDING TO SIZE OF FLOCK

Item	Size of flock		
	Less than 200 hens	200–399 hens	400 hens and over
Number of farms	26	17	18
Average number of hens per flock	76	272	747
Average number of toms per flock	8	33	81
Average pounds of feed consumed per bird	83	74	72
Average egg production per hen	35.4	39	43.3
Average number fertile eggs per hen	23.1	26.2	30.1

The data in Table 66 show that as the size of the flock increased, fewer pounds of feed were consumed per bird but greater egg production per bird was secured. This situation makes it quite clear that the birds in the largest sized flocks were of better breeding quality than the birds in the second largest sized flocks and much better

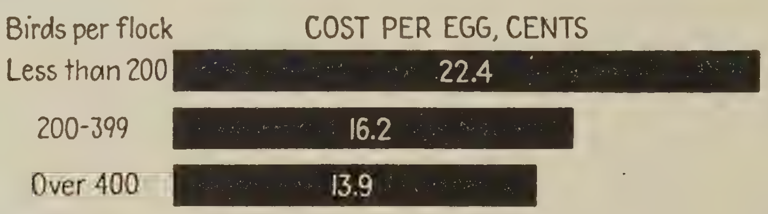


FIG. 177*A*.—As the size of the breeding flock increased, the cost of producing hatching eggs decreased in flocks in the state of Washington. (*Graph made from data of C. N. Berryman and M. T. Buchanan, Washington Experiment Station.*)

than the birds in the smallest sized flocks. More eggs on fewer pounds of feed per bird in the largest sized flock than in the other two size flocks, plus less man-hours of labor per bird, made the largest sized flocks the most efficient from the standpoint of cost of producing eggs, as shown in Fig. 177*A*.

A study on the cost of producing hatching eggs on several farms in New York State was made in 1943, the distribution of the costs per item being given in Table 67. There were 3,932 breeding birds involved and the average egg production per hen was 50 eggs.

Judging by the results of studies on the cost of producing turkey hatchings eggs in Oregon, Washington, and New York, the following conclusions are warranted: (1) high average egg production per bird is necessary for efficient utilization of feed in producing eggs most economically; (2) mortality of breeding stock must be kept at a minimum in order to keep flock depreciation costs as low as possible; (3) labor in caring for the flock must be utilized as efficiently as possible, large flocks having the advantage over small flocks from the standpoint of man-hours of labor required per bird.

TABLE 67. COST OF PRODUCING HATCHING EGGS IN NEW YORK IN 1943
(E. G. Misner, Cornell University, 1944)

Item	Cost per breeder	Cost per 100 eggs	Per cent of total cost
Feed	$3.31	$ 8.72	39.6
Depreciation of stock	2.15	5.66	25.7
Labor	1.41	3.71	16.8
Use of land, buildings, and equipment	0.69	1.80	8.2
Interest	0.34	0.90	4.1
Use of auto and truck	0.22	0.57	2.6
Miscellaneous	0.25	0.65	3.0
Total gross cost	$8.37	$22.01	100.0
Credit for manure	0.01	0.04	
Credit for eggs used	0.02	0.04	
Total net cost	$8.34	$21.93	

4. Hatching Poults Economically

In the state of Washington in 1942 hatcherymen charged an average of 4 cents per egg for hatching poults. The average cost of producing salable poults was 38.46 cents per poult, and approximately 53 salable poults were secured per 100 hatching eggs produced.

In the state of New York in 1943 an average of 52.3 salable poults

TABLE 68. COST OF HATCHING POULTS IN NEW YORK IN 1943
(E. G. Misner, Cornell University, 1944)

Item	Cost per 1,000 eggs incubated	Cost per poult hatched	Per cent of total cost
Turkey breeders' own eggs	$209.36	$0.401	75.2
Hatching eggs purchased	18.73	0.036	6.7
Labor	15.91	0.031	5.7
Use of buildings and equipment	13.79	0.026	4.9
Use of auto and truck	3.75	0.007	1.4
Interest on costs	0.47	0.001	0.2
Miscellaneous	16.33	0.031	5.7
Total cost	$278.34	$0.533	100.0

were secured per 100 hatching eggs produced. The distribution of cost factors in hatching poults in New York in 1943 is given in Table 68.

Two factors of greatest importance affecting the number of salable poults secured per 100 eggs incubated are the fertility of the eggs and the hatchability of the fertile eggs. Producing infertile eggs is a waste of money. The cost of hatching poults is directly proportional to the number of poults secured per 100 eggs set, good hatching quality of the fertile eggs being necessary to produce poults at the least cost.

FIG. 177*B*.—A turkey grower can always learn something from the other fellow. In the background of this picture is a group of Utah turkey growers "talking turkey" with a neighbor. Utah has many large commercial flocks. (*Carl Frischknecht, Utah Agricultural College.*)

An analysis of the results of the survey of the cost of producing hatching eggs and poults in Washington State in 1942 brings out three interesting features: (1) 40.8 eggs per hen during the 139-day breeding season means laying at the rate of only 29.3 per cent or at the rate of a little over 2 eggs every week (no wonder it costs most turkey breeders too much to produce hatching eggs); (2) out of every 100 hatching eggs produced, 31.8 were infertile or apparently infertile when tested during incubation, so that out of every 100 eggs produced only 68.2 are left as a source of poults; (3) out of every 100 fertile eggs, embryos died in 21.8 of them, so that out of 68.2 fertile eggs only 53.4 salable poults were secured. You see, therefore, that out of every 100 eggs produced only 53.4 salable poults were secured.

The cost of producing hatching eggs was 16.5 cents per egg and the cost of producing poults was 38.5 cents per poult, the tremendous difference being due to low fertility and low hatchability.

The survey of the cost of producing hatching eggs in New York State in 1943 shows that out of every 100 hatching eggs produced, only 52.3 salable poults were secured.

In most turkey-breeding flocks in the United States, the production of hatching eggs and poults is not nearly so economical as it should be because of the following factors: (1) egg production per bird is too low; (2) fertility is too low; and (3) hatchability of fertile eggs is too low. The result is that there are too few poults secured per 100 eggs produced and too few poults secured per hen in the breeding flock. In Chap. 2 you have learned how to secure higher egg production per bird, better fertility, and better hatchability. By putting into practice the suggestions given, it should be possible for you to increase the returns from your flocks very materially.

TABLE 69. AVERAGE PRICES PAID BY FARMERS FOR TURKEY POULTS IN 1943, 1944, AND 1945 BY STATES, CENTS PER POULT

(Bureau of Agricultural Economics, U.S. Department of Agriculture)

State	1943	1944	1945	State	1943	1944	1945
Maine	54.00	60.00	80.00	West Virginia	46.00	57.00	68.00
New Hampshire	55.00	65.00	85.00	North Carolina	42.50	55.00	68.00
Vermont	59.00	67.00	80.00	South Carolina	35.00	64.00	66.00
Massachusetts	50.00	70.00	83.00	Georgia	35.00	40.00	50.00
Rhode Island	51.00	74.00	80.00	Florida	33.00	35.00	65.00
Connecticut	50.00	80.00	85.00	Kentucky	35.50	37.00	60.00
New York	56.00	75.00	80.00	Tennessee	37.00	40.00	50.00
New Jersey	55.00	73.00	80.00	Alabama	40.00	45.00	46.00
Pennsylvania	53.00	63.00	73.00	Mississippi	35.50	56.00	56.00
Ohio	53.00	62.00	72.00	Arkansas	45.00	60.00	70.00
Indiana	51.00	60.00	77.00	Louisiana	31.00	33.00	53.00
Illinois	47.50	52.00	70.00	Oklahoma	41.00	60.00	65.00
Michigan	61.00	80.00	80.00	Texas	46.00	51.00	64.00
Wisconsin	58.00	66.00	83.00	Montana	62.00	80.00	80.00
Minnesota	68.00	81.00	84.00	Idaho	64.00	72.00	78.00
Iowa	54.00	76.00	76.00	Wyoming	62.00	72.00	83.00
Missouri	46.00	52.00	63.00	Colorado	66.00	83.00	86.00
North Dakota	56.00	68.00	79.00	New Mexico	54.00	70.00	70.00
South Dakota	48.00	73.00	76.00	Arizona	53.00	72.00	76.00
Nebraska	57.00	70.00	70.00	Utah	72.00	85.00	88.00
Kansas	52.00	60.00	73.00	Nevada	70.00	82.00	82.00
Delaware	55.00	65.00	72.00	Washington	54.00	66.00	74.00
Maryland	52.00	68.00	75.00	Oregon	58.00	73.00	75.00
Virginia	46.50	61.00	73.00	California	64.00	72.00	78.00

In Table 69 are given the average prices of poults by states during 1943, 1944, and 1945. Note the marked increase in price in 1944 over 1943 and in 1945 over 1944. Also note the great variation in price among various states each year, this being true in several cases with respect to adjoining states.

5. Raising Turkeys Economically

Fewer pounds of feed per pound of turkey raised should be your goal, if you want to make the most profit out of your turkey enterprise. The cost of raising turkeys varies from year to year and among different sections of the country in the same year. At the same time, certain cost factors have about the same relative importance every year and in all sections of the country. The number of pounds of feed required to raise your turkeys to prime market condition is one of the most important factors affecting your profits, because feed

TABLE 70. COSTS OF RAISING TURKEYS IN RIVERSIDE AND STANISLAUS COUNTIES, CALIFORNIA

(V. S. Asmundson, from data collected and analyzed by California Extension Service, 1944)

Item	Riverside County			Stanislaus County, 1941
	1937	1938	1939	
Percentage raised	65.5	78.0	77.2	77.5
Average number raised	.....*	1219	1166	3412
Hours of labor per bird	1.02	1.3	0.8	0.7
Average live weight per bird	14.8	15.5	14.9	19.4
Grain, pounds per bird	23.6	22.4	29.4	34.6
Mash, pounds per bird	58.0	51.9	43.4	58.2
Total feed, pounds per bird	81.6	74.3	72.8	92.8
Pounds feed per pound gain	5.5	4.8	4.9	4.8
Cost of feed per bird, dollars	1.82	1.44	1.42	1.92
Cost per poult, dollars	0.44	0.38	0.38	0.45
Cost of labor per bird, dollars	0.31	0.40	0.23	0.22
Interest on investment, per bird, dollars	0.08	0.06	0.06	0.08
Depreciation cost per bird, dollars	0.07	0.05	0.02	0.04
Miscellaneous cost per bird, dollars	0.08	0.08	0.04	0.08
Total cost per bird, dollars	2.80	2.41	2.15	2.79
Total income per bird, dollars	2.91	3.17	2.45	4.05
Profit per bird, dollars	0.11	0.76	0.30	1.26
Average investment per bird, dollars	1.33	1.20	1.20	1.60
Total cost per pound, cents	18.9	15.6	14.4	14.4
Total income per pound, cents	19.7	20.5	16.4	20.9
Profit per pound, cents	0.8	4.9	2.0	6.5

* Data not available.

costs normally represent over one-half of the total cost of raising turkeys. Always keep in mind that the number of pounds of feed per pound of turkey raised is influenced by the amount of mortality, because the feed consumed by the birds that died must be included with the amount consumed by the birds that lived.

Data on costs of producing turkeys in Riverside County in 1937, 1938, and 1939 and in Stanislaus County, California, in 1941 are given in Table 70.

Fig. 177*C*.—Turkey growers benefit from swapping ideas at meetings and by attending demonstrations. A turkey field meeting in Harrison County, Kentucky. (*W. M. Insko, Jr., Kentucky Experiment Station.*)

The data in Table 70 show that feed costs amounted to over one-half of the total cost of raising turkeys. The cost of poults was the second most important cost factor, and the cost of labor, including hired and family labor, was the third most important cost factor. The relatively high mortality reduced profits considerably.

Costs of raising turkeys were determined on 112 farms in 1942 in Clark and Island counties and in the Yakima Valley, three leading turkey-producing areas of Washington State. All growers except one had Broad-breasted Bronze flocks. The average number of poults purchased per farm was 2,325 and the average number of turkeys raised per farm was 1,904, mortality averaging 18.1 per cent. Feed consumed per bird averaged 100.1 lb. and man-labor averaged 0.87 hr. per bird, including labor used in killing and dressing the birds. The average dressed weight was 18.3 lb. per bird, feed consumed per pound of dressed turkey produced averaging 5.47 lb. The average feed cost per pound of dressed turkey produced was 15.2 cents and the average total cost per pound of dressed turkey produced was 25.2 cents. The average total cost per dressed bird produced was $4.61.

Charges for the use and depreciation of the buildings and equipment were at the rate of 15 per cent of the total value, and the interest rate on operating capital was 6 per cent for a period of 4 months. About 75 per cent of the growers used credit for their operations, the great majority obtaining credit from feed dealers, while a few obtained credit from local banks. In most cases credit was extended only after the poults were 6 weeks old, the collateral being a first mortgage on the turkeys.

The distribution of costs in producing turkeys in Washington State in 1942 is given in Table 71.

Table 71. Turkey Production Costs on 112 Farms in Washington in 1942
(C. N. Berryman and M. T. Buchanan, Washington Experiment Station, 1944)

Item	Cost per dressed turkey, cents	Cost per pound of dressed turkey, cents	Per cent of total cost
Feed	278.4	15.21	60.4
Labor	94.2	5.15	20.4
Poults	53.8	2.94	11.7
Use of buildings and equipment	8.0	0.44	1.7
Power equipment	7.8	0.43	1.7
Use of land	4.8	0.26	1.0
Interest on operating capital	7.7	0.42	1.7
Miscellaneous	6.2	0.34	1.3
Total	460.9	25.19	99.9

A thorough and detailed study of the cost of raising turkeys was made in Utah in 1942. Records were analyzed pertaining to 68 flocks in Sanpete, Servier, Box Elder, and Cache counties. Among the 68 turkey raisers whose records were studied, 49 bought day-old poults, 12 bought started poults that were from 6 to 8 weeks old, and 7 raised two flocks by purchasing day-old poults and started poults 6 to 8 weeks old because of limited brooding facilities. For all 68 flocks the average number of poults purchased per flock was 3,723 and the average number of turkeys raised per flock was 2,757. The different items of cost in raising the turkeys are given in Table 72.

TABLE 72. DISTRIBUTION OF TURKEY-RAISING COSTS PER FLOCK IN UTAH IN 1942
(D. A. Broadbent, W. P. Thomas, and G. T. Blanch, Utah Experiment Station, 1944)

Item	Cost per flock	Per cent of total cost
Feed	$ 6,197	57.3
Poults	2,388	22.2
Labor	1,102	10.2
Equipment and improvements	514	4.7
Interest	331	3.1
Miscellaneous	284	2.5
Total	$10,816	100.0

Based on the data in Table 72, the cost of feed, poults, and labor amounted to 89.7 per cent of the total cost of raising turkeys in the case of these 68 flocks in Utah in 1942. The mashes used cost on the average $50 per ton or $2.50 per 100 lb. and the scratch grain cost on the average $31.80 per ton or $1.59 per 100 lb. The amount of feed consumed per turkey raised was 112 lb. for turkeys raised on the average to 217 days of age, at which time they weighed an average of 16.83 lb. each. The cost of day-old poults ranged from 40 to 60 cents each, with an average of 52 cents, and started poults ranged from 75 cents to $1.35 each, with an average of $1.16. Family and hired labor was at the rate of $3 per day per person.

Since there were 49 turkey raisers who purchased day-old poults only, 12 who purchased started poults only, and 7 who purchased both day-old and started poults, the cost factors per turkey raised and per pound of turkey produced are considered from the standpoint of each group of flocks.

In Table 73 are given the costs, receipts, and profits per turkey raised for each of the three groups of flocks and for the 68 flocks.

It is to be noted in Table 73 that in the case of the 49 day-old flocks the poult cost per turkey raised is considerably higher than the original cost of 52 cents per poult. The poult cost per turkey raised is determined, however, by the percentage of poults raised as well as the original day-old price. In the case of the 49 day-old flocks, mortality increased the original day-old poult cost from 52 cents to 72 cents per turkey raised. In the case of the started flocks, mortality increased the original started-poult cost from $1.16 to $1.34 per turkey raised.

The greatest profit per turkey was made by the group of 49 turkey raisers who purchased day-old poults, and the least profit per turkey raised was made by the group of 12 turkey raisers who bought started poults.

TABLE 73. COSTS, RECEIPTS, AND PROFITS PER TURKEY RAISED IN UTAH IN 1942
(D. A. Broadbent, W. P. Thomas, and G. T. Blanch, Utah Experiment Station, 1944)

Item	49 day-old flocks	12 started flocks	7 mixed flocks	All flocks
Cost of feed	$2.28	$2.11	$2.28	$2.25
Cost per poult	0.72	1.34	1.02	0.87
Cost of labor	0.44	0.27	0.37	0.40
Use of equipment, etc	0.20	0.11	0.18	0.18
Interest costs	0.13	0.09	0.12	0.12
Miscellaneous costs	0.11	0.08	0.09	0.10
Total costs	$3.88	$4.00	$4.05	$3.92
Receipts	5.69	5.05	5.71	5.58
Profit	1.81	1.05	1.66	1.66

Since turkeys are sold by the pound and the total weight of turkeys sold is determined by the number of turkeys raised and their average weight per pound, it is important for turkey raisers to determine profit per pound of turkey produced as a measure of efficiency in raising

TABLE 74. COSTS, RECEIPTS, AND PROFITS PER POUND OF TURKEY PRODUCED IN UTAH IN 1942
(D. A. Broadbent, W. P. Thomas, and G. T. Blanch, Utah Experiment Station, 1944)

Item	49 day-old flocks, cents	12 started flocks, cents	7 mixed flocks, cents	All flocks, cents
Cost of feed	13.2	13.6	13.9	13.4
Cost per poult	4.2	8.7	6.2	5.1
Cost of labor	2.5	1.7	2.2	2.4
Use of equipment, etc	1.2	0.7	1.1	1.1
Interest costs	0.8	0.6	0.7	0.7
Miscellaneous costs	0.6	0.5	0.6	0.6
Total costs	22.5	25.8	24.7	23.3
Receipts	33.0	32.5	34.8	33.2
Profit	10.5	6.7	10.1	9.9

turkeys. In Table 74 are given the costs, receipts, and the profits per pound of turkey produced for each of the three groups of flocks and for the 68 flocks.

The data in Table 74 indicate that those who purchased day-old poults only made the greatest profit per pound and those who purchased started poults made the least profit per pound.

Comparisons were made concerning costs of production and profits between the smallest and the largest flocks raised under comparable conditions. Labor was utilized more efficiently, feed was purchased at a slightly lower price per ton, and other costs per unit were slightly less in the largest flocks than in the smallest flocks, but mortality was sufficiently greater in the largest flocks than in the

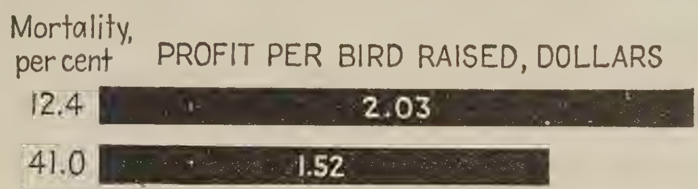


FIG. 178.—In Utah it was found that among 16 flocks total poult mortality was 28.6 per cent greater than among 16 other flocks, the average profit per bird for the 16 flocks having the higher mortality being 51 cents less than for the other 16 flocks. (*Graph made from data of the D. A. Broadbent, W. P. Thomas, and G. T. Blanch, Utah Experiment Station.*)

smallest flocks so that the profit per turkey was the same for both groups of flocks.

Poult mortality during the brooding period and on range may be so high that, instead of making any profit, a loss is sustained in the turkey enterprise. Poults that die yield nothing in return except possibly fertilizer value. The number of poults marketed in relation to the original number purchased affects costs and profits. Always keep in mind that mortality affects costs of production more than receipts. The cost of the poults that die, the cost of the feed they consumed, and other costs involved in raising them to the time they died must all be borne by the turkeys that are raised to market age. Figure 178 shows how profit per bird is affected by high mortality.

The distribution of costs in raising turkeys in New York State in 1943 is given in Table 75, the survey of costs involving 58,880 young turkeys on 32 farms or an average of 1,840 poults per farm.

Based on the data in Table 75, in New York State in 1943 the cost of feed, labor, and poults started amounted to $5.42 per bird or 85.8 per cent of the total cost and 86.4 per cent of the net cost of raising turkeys to market age.

Table 75. Distribution of Costs in Raising Turkeys in New York State in 1943
(E. G. Misher, Cornell University, 1944)

Item	Cost per bird	Per cent of total cost
Feed	$3.24	51.3
Labor	1.21	19.2
Poults	0.97	15.3
Use of land, buildings, and equipment	0.32	5.1
Use of auto, truck and tractor	0.19	2.9
Interest on costs	0.07	1.1
Interest on stock	0.03	0.5
Miscellaneous costs	0.29	4.6
Total	$6.32	100.0
Credit for manure	0.02	
Credit for feathers	0.03	
Net cost	$6.27	

Raising turkeys more economically could be accomplished by most turkey raisers through securing faster growing strains of turkeys that utilize feed more efficiently in making gains in body weight, managing the flock more efficiently or increasing the size of the flock to reduce labor cost per bird, and being able to purchase less expensive poults. This should be possible if turkey breeders secured higher egg production per bird and better fertility and hatchability of the eggs produced.

SUMMARY

1. The turkey producer who secures his feed and other items at wholesale prices and sells his turkeys at retail prices has a tremendous advantage over the producer who buys his feed and other items at retail prices and sells his turkeys at wholesale prices.

2. During recent years, the turkey industry has shown a tendency to expand because turkey production has been a relatively profitable enterprise.

3. During the Second World War there were heavy demands for turkey meat, resulting in still further expansion of the turkey industry. This means that in the future it will undoubtedly be necessary to reduce costs of production to the minimum through efficient management.

4. Keep a record of all expenses and receipts from your turkey enterprise.

5. The cost of feed is the most important item in producing hatching eggs, followed by the depreciation in value and mortality in the breeding stock.

6. High average egg production per bird is necessary for efficient utilization of feed in producing hatching eggs most economically.

7. In most turkey breeding flocks, the cost of producing poults could be reduced by securing more eggs per bird, better fertility, and higher hatchability.

8. Fewer pounds of feed per pound of turkey raised should be your goal, if you want to make the most profit out of your turkey enterprise. Mortality must be kept at a minimum.

9. The cost of feed represents about one-half of the total cost of raising poults. Therefore, secure poults of superior quality, that will utilize feed efficiently, feed well-balanced diets, and do not waste feed by using a poor type of hopper or filling hoppers too full.

10. Given good stock, success in the turkey enterprise is largely a matter of managerial ability.

PART II

RAISING DUCKS, GEESE, GAME BIRDS, AND OTHER BIRDS

9. Raising and Marketing Ducks

DUCK raising is an important industry in the United States when one considers the large number of farms on which ducks have been raised annually for over 150 years and the extensive development of commercial duck farming during the last 75 years. In the early history of the country wild ducks were relatively plentiful, so that there was not much incentive to raise ducks for food purposes. With the rapid expansion of the country, however, the increase in human population and the increasing scarcity of game birds led many farmers to keep a few ducks for food production. The development of the cities created a demand for duck flesh, especially on the part of the foreign-born population, and commercial duck production expanded from its early beginnings in about 1850. The "dark meat" of ducks provides consumers with a change from the "white meat" of chickens and turkeys. Moreover, well-bred ducks properly managed grow rapidly during the first few weeks and are efficient converters of feed into flesh. Raising and marketing ducks are discussed in this chapter under the following major activities:

1. Keeping Good Stock
2. Breeding for Egg and Meat Production
3. Incubating Duck Eggs
4. Rearing Ducklings
5. Feeding Breeders and Young Ducks
6. Marketing Ducks, Feathers, and Eggs
7. Controlling Duck Diseases

1. Keeping Good Stock

Raising ducks for meat production rather than for egg production has been the principal interest of farmers and commercial duck raisers. Duck-egg production has never attained the importance in this country that it has in either England or Holland.

Before discussing the different breeds and varieties of ducks, mention should be made of the different parts of a duck so that you will be familiar with terms used to describe differences between the breeds and varieties, especially with respect to various parts of the plumage (see Fig. 179). Note that the bird illustrated has curled tail feathers ust above the main tail feathers and, therefore, is a drake, the female duck having no curled tail feathers.

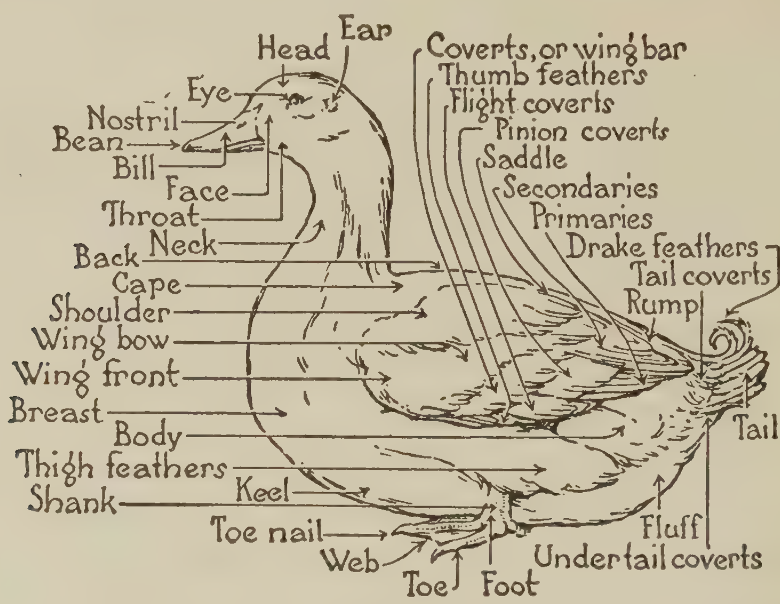


FIG. 179.—The parts of a drake, with special reference to the plumage. ("*From Fowls of Forest and Stream Tamed by Man*," *by Morley A. Jull*, *courtesy The National Geographic Magazine*, *March*, 1930.)

There are 11 breeds of ducks recognized in the American Standard of Perfection. These 11 breeds may be grouped as follows: (1) those kept primarily for meat production; (2) those kept primarily for egg production; (3) those kept primarily for ornament or fancy, especially

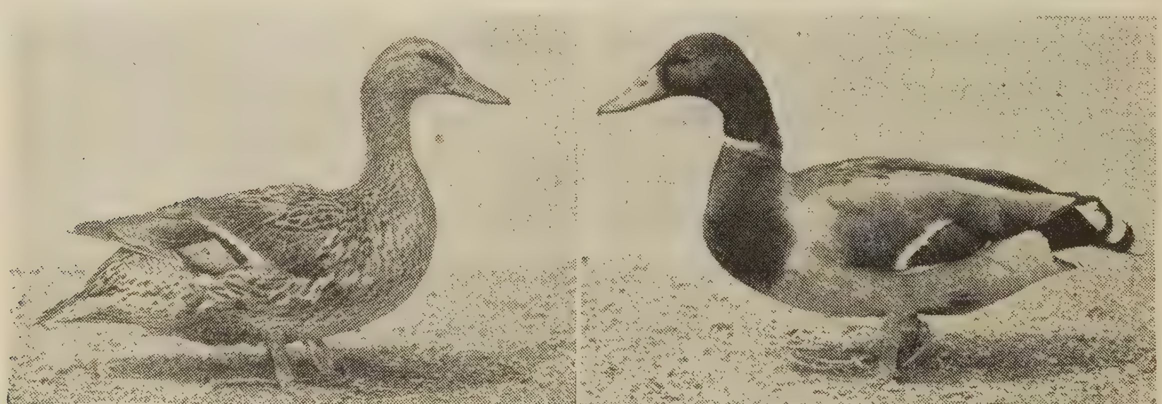


FIG. 180.—Wild Mallard duck (left) and drake (right). The Wild Mallard gave rise to all domestic breeds of ducks except the Muscovy. (*U.S. Department of Agriculture.*)

where ponds of water are available. For meat production you have your choice among the following breeds: Pekin, Rouen, Cayuga, Muscovy, and Aylesbury. The two standard-bred egg-producing breeds are the Runner and the Buff, although in England the Khaki-

Campbell has also assumed a prominent place as an egg producer. Fancy breeds include the following: Call, Crested, East India, and Blue Swedish, although there are numerous nonstandard breeds that have very attractive plumage, especially the Wood and Mandarin breeds.

All the breeds mentioned above, except the Muscovy, are descended from the wild Mallard (see Fig. 180), which inhabits most parts of the world. The wild Mallard is relatively small and is easily domesticated. In early times settlers often collected wild Mallard eggs and hatched them under hens or caught young Mallard ducklings and raised them on the premises, flight being prevented by removing the outer part of the wing, from the first joint.

Keeping Meat-producing Breeds. Among the five meat-producing breeds mentioned previously, the Pekin is by far the most popular. In fact, the Pekin is the only breed raised commercially for meat production. The Muscovy is still raised on some farms.

Pekin. The Pekin breed is of Chinese origin and through several generations of selection and breeding for rapid growth has become of outstanding economic importance. The plumage is white; the body is long, broad, and deep with a full breast; the color of the skin is yellow; the shanks and feet are reddish orange; and the bill is orange yellow. The standard weights are: adult drake, 9 lb.; adult duck, 8 lb.; young drake, 8 lb.; young duck, 7 lb.

Rouen. This breed takes its name from the town of Rouen in Normandy and its plumage color is similar to the wild Mallard. In size and shape the Rouen is similar to the Pekin and it has the same standard weights. Although a good meat bird, it has not been kept extensively for meat production and at present is raised principally by fanciers.

Cayuga. This breed has solid black plumage and is 1 lb. lighter in standard weight than the Pekin. It derived its name from Cayuga County in New York State but has never become very popular, probably largely because of its black plumage.

Muscovy. This breed is of South American origin and differs from all other breeds of ducks, since it roosts in trees or other convenient places because of its flying tendencies and the females do not quack. It is a good forager but is not economically important because it does not grow so rapidly as the Pekin and is thus not so efficient in utilizing feed. Moreover, the sexes differ considerably in weight, the standard weights being as follows: adult drake, 10 lb.;

adult duck, 7 lb.; young drake, 8 lb.; young duck, 6 lb. Because of the relatively small size of the female as compared with the male, it is hard to understand why farmers keep the Muscovy duck for the production of duck meat.

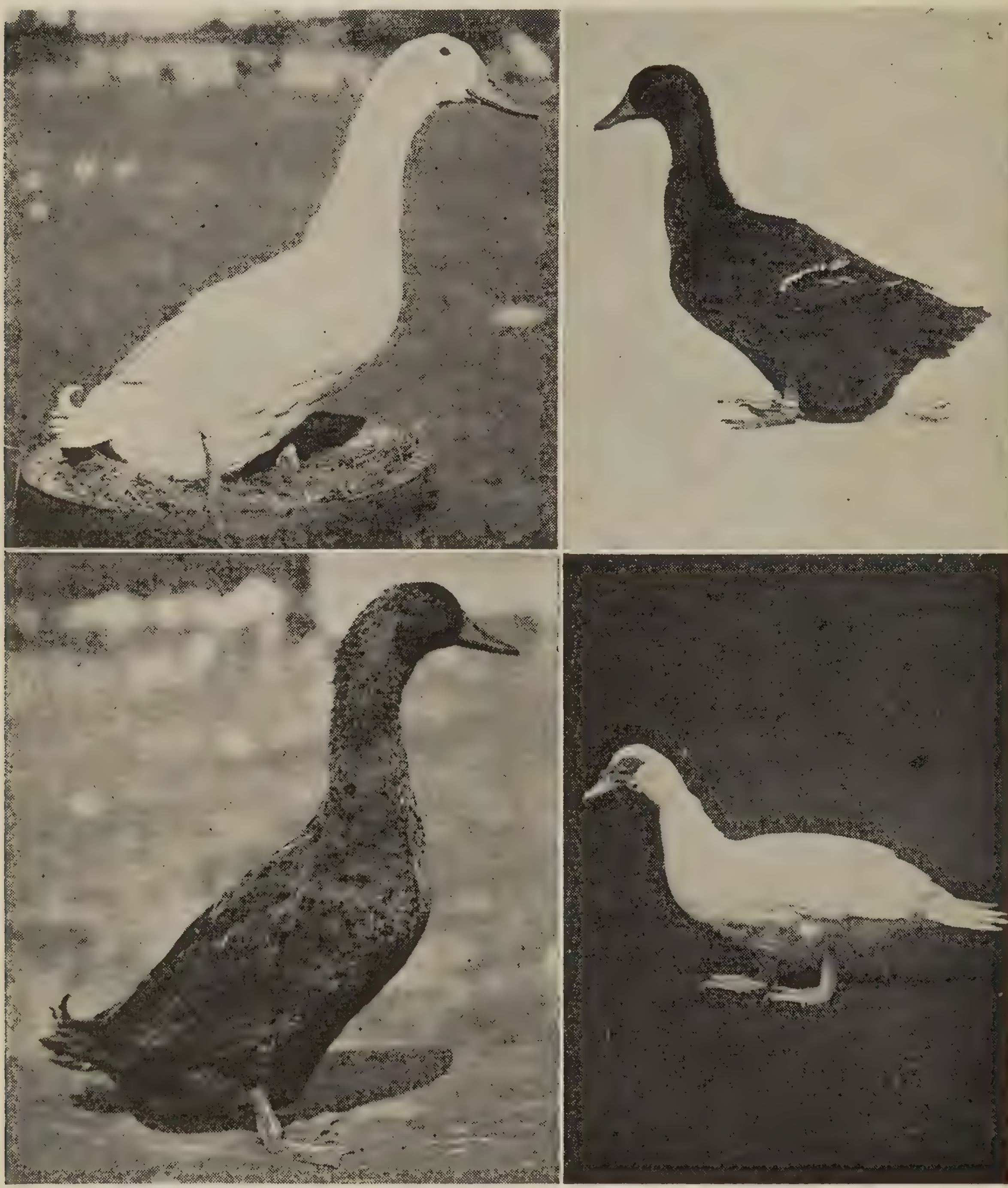


Fig. 181*A*.—Breeds of ducks for meat production. Upper left, Pekin drake. Upper right, Rouen duck. Lower left, Cayuga drake. Lower right, White Muscovy drake. (*U.S. Department of Agriculture.*)

There are two varieties of the Muscovy breed, the White and the Colored. Both varieties are characterized by having red, caruncu-lated skin over the head and face. The White Muscovy has white plumage, pale orange-yellow shanks, and a flesh-colored bill. The Colored Muscovy has a lustrous black breast, body, and back broken with some white; the bill is pink; and the shanks are yellow or a dark leaden color.

Aylesbury. This is an English breed with white plumage; it has the same standard weights as the Pekin, but it has never gained popularity in the United States. The bill is flesh-colored and the shanks and toes are light orange. In England the Aylesbury is extremely popular.

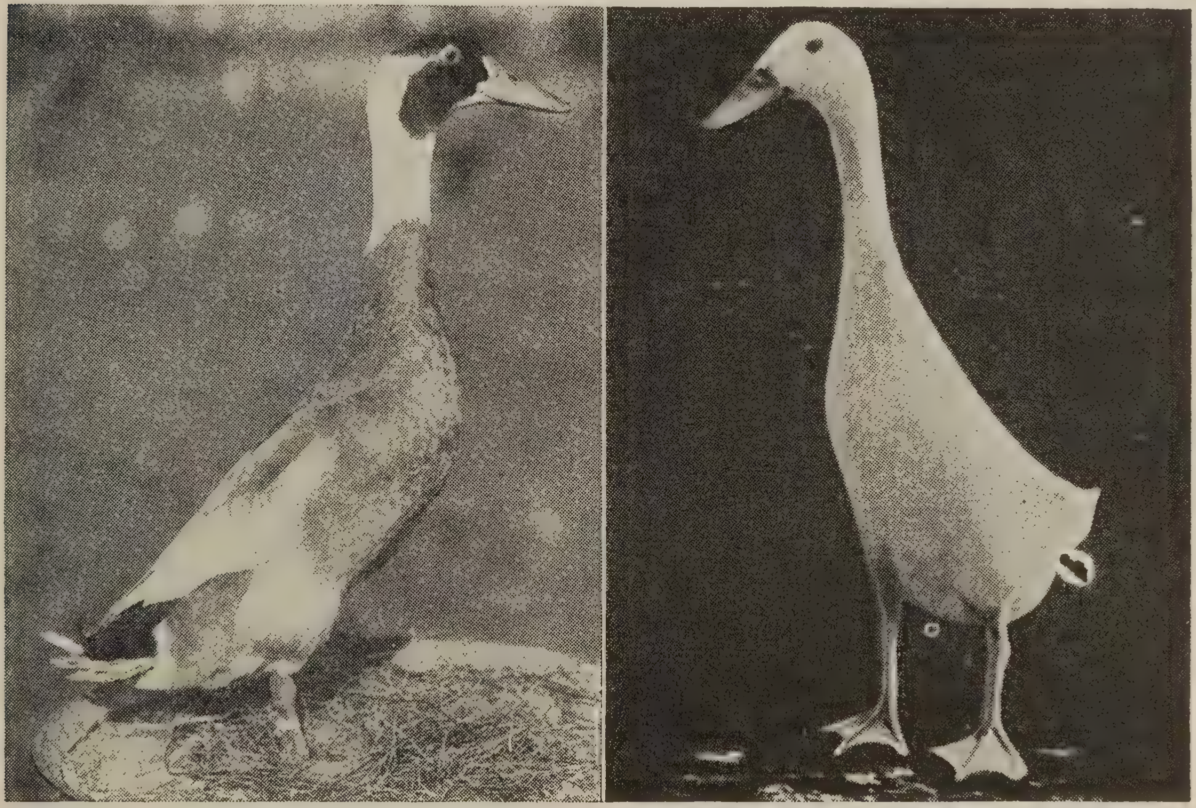


FIG. 181*B*.—Ducks for egg production. Left, Penciled Runner. Right, White Runner. (*U.S. Department of Agriculture.*)

Keeping Egg-producing Breeds. The Runner and the Buff are the only recognized standard egg-producing breeds in the United States. The English-originated Khaki-Campbell is apparently gaining in favor. There are three varieties of Runners: White, Penciled, and Fawn and White. All Runner ducks are small in size and have a very upright carriage of the body. The standard weights are adult drake, 4.5 lb.; adult duck, 4 lb.; young drake, 4 lb.; young duck 3.5 lb. The white plumage of the White variety is offset by a yellow bill and orange shanks and toes. The Fawn and White variety is fawn or gray and white with a white neck and white running up to the eyes and extending around the bill; the back and shoulders as well as the upper part of the breast and wings are fawn. The Penciled variety resembles the Fawn and White variety, except that the head of the Penciled male is a dull bronze-green and white; the back is fawn, finely stippled with a slightly darker shade of fawn; the body and upper section of the breast are medium fawn, and the tail is a dull bronze-green in shade. The head of the female Penciled variety is a medium fawn and white, while the white markings resemble those of the male and the colored markings are medium fawn throughout. Well-bred flocks of Runner ducks are noted for exceptionally high egg records, the highest world's record, insofar as is known, being 363 eggs in 365 days made in a contest in New Zealand.

Buff. This breed, sometimes called the Buff Orpington, was originated in England, where it has given a good account of itself

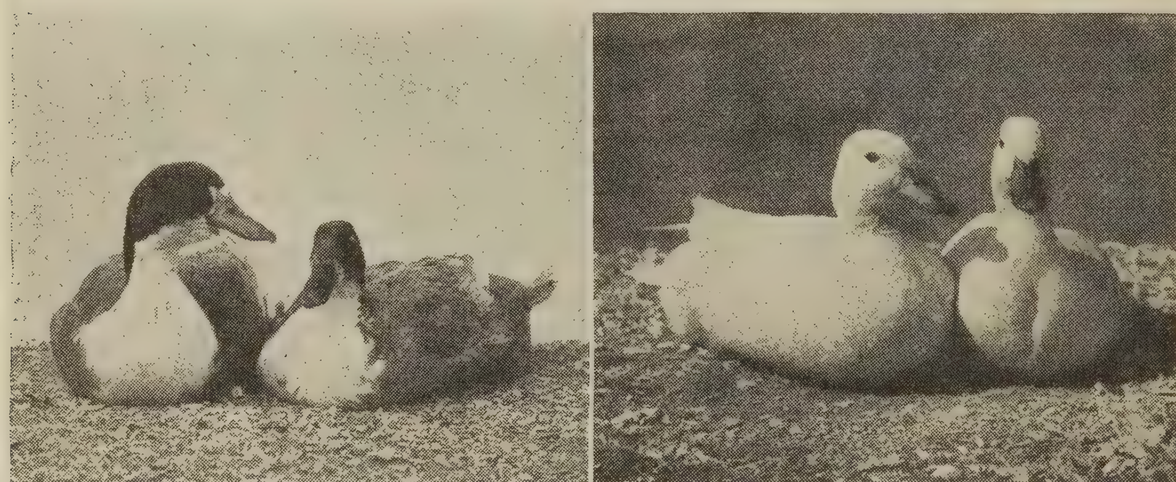


Fig. 182.—Ornamental breeds of ducks. Left, Blue Swedish. Right, White Call. (*U.S. Department of Agriculture.*)

as an egg producer. It is kept to only a limited extent in the United States. The plumage is an even shade of fawn buff, except that in the drake the head and upper portion of the neck are seal brown.

Khaki-Campbell. This breed is not kept in large numbers in the United States but is a popular egg producer in England and some of the European countries. It is larger than the Runner and is buff in color, except for bronze shading in the head, neck, and wings of the male.

Keeping Ornamental Breeds. The Call, Crested, East India, Blue Swedish, Wood, and Mandarin breeds need but brief mention because they are bred to limited extent only. The Call breed is very small in size and comprises two varieties, the White and the Gray, the latter closely resembling the wild Mallard. The Crested breed is simply a small-sized White breed with a crest of feathers on the top of the head. The East India is a small-sized black breed. The Blue Swedish is a very ornamental breed, with blue plumage in all sections, except for a white front extending from the base of the bill down to the breast, as shown in Fig. 182. The Wood and Mandarin breeds have very beautiful plumage, consisting of many brilliant colors in distinct patterns.

2. Breeding for Egg and Meat Production

Whatever breed of ducks you keep, you want them to lay well in order to secure a reasonable number of progeny. A bred-to-lay

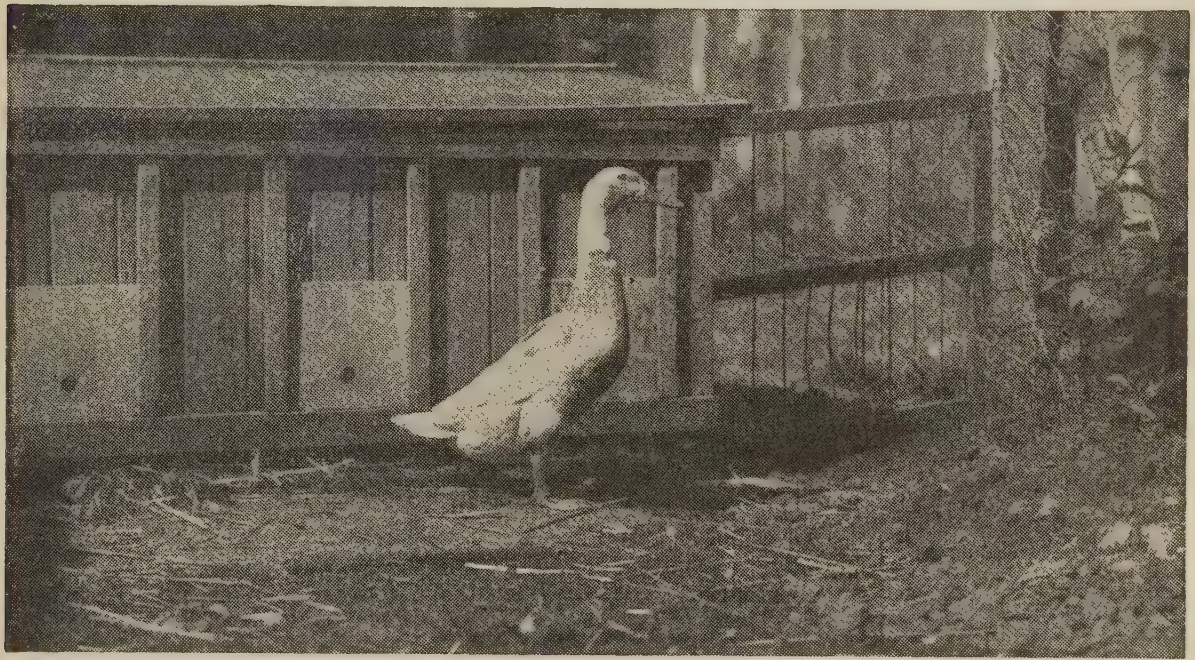


Fig. 183.—A Runner duck with trap nests. The trap part of the nest, the board with the hole near the bottom, is raised to let one duck at a time in each nest, the trap falling after the duck has entered. Eggs are gathered by raising the hinged top.

strain of ducks is absolutely essential if you are interested in commercial duck-egg production. Good egg production is necessary if you raise ducks for meat production in order to keep the cost of producing ducklings at a minimum.

Developing an Egg-producing Strain. As mentioned previously, there is very little interest in the United States in producing duck eggs for human consumption. Flocks of Runners or Khaki-Campbells that are kept for this purpose had their origin from imported stock. In England, Belgium, Holland, and some other countries high egg-producing strains have been developed by trap-nesting and pedigree breeding along the same lines followed with chickens, discussed in "Successful Poultry Management," and turkeys, discussed in Chap. 2 of this book. Progeny testing, which consists of selecting breeders from families of full sisters with high average egg-production records, is practiced. Particular attention is paid to the selection of drakes for future breeding purposes from sires and dams that produce superior progeny. Flocks averaging well over 200 eggs per bird are quite common.

Developing a Meat-producing Strain. For years in the United States many Pekin duck breeders have selected breeding stock for rapid growth and efficient meat production. If you are interested in producing duck meat as efficiently as possible you should keep Pekins that have been bred for rapid growth and good fleshing.

A breeding flock consists of 1 drake and 5 or 6 females or on a commercial breeding plant about 20 drakes and 100 females in northern sections of the country and about 17 drakes and 100 females in sections where the climate is milder. The females commence laying when about 7 months old and will continue in good production for approximately 9 or 10 months, if well-bred birds are kept and if they are fed good diets and are properly managed. Commercial duck raisers usually do not keep the breeders over for a second laying season, although a portion of the best of the flock might well be kept for the express purpose of producing more breeding stock possessing possibly greater vigor than the progeny of first-year layers.

Most commercial duck producers raise several broods of ducklings during the year; as a matter of fact, at regular intervals a new batch of ducklings is produced in order that the supply of market ducks is maintained at a fairly constant level throughout the year. The problem presents itself, therefore, concerning from which particular hatch of ducklings the breeder should select his future breeding stock. The breeder must decide from which particular hatch he intends to select his future breeds based on the assumption that the females from that hatch will start to lay approximately 7 months from the time they were hatched. The drakes for breeding are usually selected in early June and the females in early July. Having decided upon the particular hatch from which breeders are to be selected, there are certain factors of importance that the duck breeder should keep in mind in the selection of future breeders from among the ducklings produced in that particular hatch.

Go over the flock of ducklings from which future breeding stock is to be selected when they are about 7 weeks of age and select future breeders on the following basis: (1) look for males and females possessing heads in proportion to the size of the body, avoiding ducklings with coarse heads; (2) select birds with bright, prominent eyes; (3) select those possessing deep, broad bodies that are well fleshed over the breasts; (4) make sure that birds can "walk straight" and are not bow-legged; (5) pay particular attention to body weight and flesh development at the time of selection because this has an important bearing on the relative efficiency in the utilization of feed or converting feed into duck meat.

At about 9 weeks of age, go over the birds again that were selected for breeders at 7 weeks of age and cull out those lacking in length,

FIG. 184.—Pekin ducklings about 7 weeks of age. The first selection of future breeding stock should be made at this age. (*U.S. Department of Agriculture.*)

depth, and breadth of body and fleshing over the breasts. Always keep in mind that for every bird of inferior quality that is kept for breeding purposes, the proportion of second-grade ducklings produced is increased. Since each male breeder has, on the average, approximately five or six times as many progeny as each female breeder, the selection of males of superior breeding quality is particularly important.

Progressive Pekin duck breeders carry out these steps in their selection program; however, more progress would be achieved in the development of superior strains of meat producers if duck breeders carried on a progeny-testing program. Such a program involves trap-nesting the females and pedigree hatching to determine: (1) egg production of the dam; (2) the size of egg laid; (3) the hatchability of the dam's eggs; (4) the viability of her progeny; (5) the relative age at which her female progeny commence laying; (6) the body conformation and fleshing ability of all her progeny at about 7 and again at about 9 weeks of age. If all male breeders could be progeny tested, so much the better.

In large commercial flocks there is relatively little danger of too close inbreeding, but if you maintain a small breeding flock, it would probably be wise to secure a well-bred drake every other year or so in order to avoid any decrease in the hatchability of the eggs.

Fig. 185.—Pekin breeding stock. (*U.S. Department of Agriculture.*)

Housing the Breeding Stock. Houses for the breeding stock do not need to be expensive structures. Shed-roof houses are usually used, although a gable-roof house is satisfactory. Locate the house on well-drained soil, sandy soil being preferable, and face it south or southeast. For a commercial breeding house, build it the length necessary for the number of breeders kept and from 18 to 20 ft. wide. Make the front wall about 8 ft. high and the rear wall about 5 ft. high. Provide about 5 sq. ft. of floor space per bird and do not keep more than 150 birds per pen; 100 per pen is preferable. If you build a house 20 ft. deep, each pen should be at least 25 ft. wide for 100 birds and 38 ft. wide for 150 birds, allowing some space for feed hoppers, water fountains, and nests. If you have a small-sized breeding flock on the farm, a colony house such as is used for chickens will be found satisfactory.

On sandy or well-drained soil, dirt floors are satisfactory, but they should be at least 6 in. above ground level. Dirt floors are hard to keep clean, however, and often harbor rats. If the soil where the house is to be located is not naturally well drained, a concrete floor would be desirable rather than a board floor, unless the latter can be made ratproof, is about 8 in. above the ground, and covered with 4 in. of sand.

The number and size of windows or openings to provide in the walls of the breeding house will depend to some extent on the climatic conditions of the section of the country in which you live. Duck-breeding houses need to be well ventilated. In most parts of the country, it is well to provide about one-third of the area of the front wall with windows and openings over which burlap or muslin can be hung, the area for windows being about equal to the area of the other openings. The windows are usually arranged to open inward at the top. In a long house, each pen should have a $3' \times 3'$ window in the rear wall for removing manure and bringing in new litter. The front and back windows should be arranged so that they can be removed readily to provide adequate ventilation in warm weather. Put wire netting over all window and other openings to keep out other birds and cats and dogs.

In a long house with several pens, running water and nonfreezing fountains are a practical necessity.

Provide nests to help keep the eggs clean, decrease breakage, and reduce the time required to gather them. Plan for at least one nest for each three to five breeders. Make nests of 12-in. boarding, each nest being 12 in. wide by 16 in. deep, with a 12-in. partition between nests; the partitions are nailed on one side to a 6-in. board, which in turn is nailed to the wall of the house. Along the front of the nests a 5-in. board is nailed to the partitions to help make the nests rigid. The series of nests, without tops and bottoms, is placed on the floor and is fastened either to a side wall or the rear wall.

Use shavings or straw for litter. Add fresh material as often as necessary to keep the floor relatively dry. Keep the house well ventilated to help keep the litter dry and be sure to remove the litter from around the water fountain whenever it gets very damp.

Provide a yard as wide as each pen and about 100 ft. long. Fencing around the yards should be dogproof. Many duck breeders locate their laying houses so that the end of each yard extends several feet into a stream or the beach of the ocean. Where no natural body of water is available, an artificial pond may be constructed, as shown in Fig. 186. Access to water probably tends to increase fertility in the eggs produced but it is not necessary to secure good results in the duck enterprise.

The female breeders usually start laying in December or earlier and continue laying for about 9 or 10 months. Laying takes place early in the morning, so the breeders should be confined to the house until about 9 A.M. The use of artificial lights tends to increase winter egg production and the breeders are less apt to be frightened at night

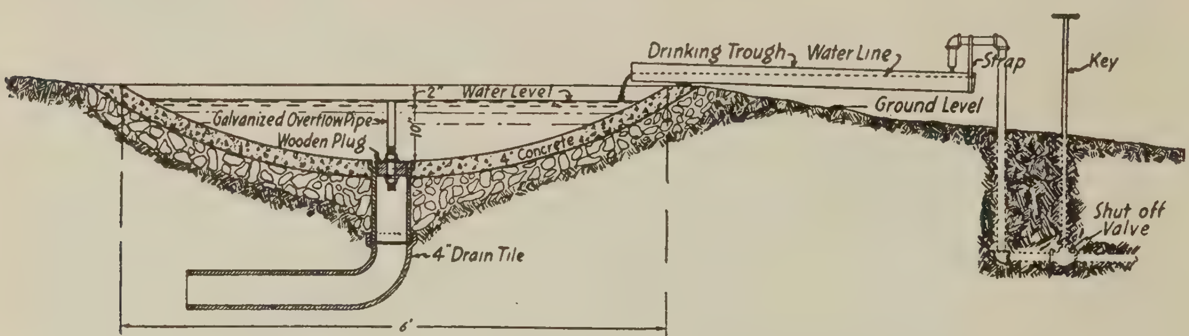


FIG. 186.—Artificial pool can substitute for running brook. The above sketch illustrates one method of constructing a concrete swimming pool. A 6′ × 6′ concrete basin, with two sides sloping as shown above, is sufficient area for as many as 200 mature ducks. Artificial ponds require frequent changing of water and thorough cleaning if they are to be satisfactory. Note provision for drinking water with trough between hydrant and pool. The overflow pipe regulates depth of water, prevents the pool from overflowing, and serves as a convenient handle on the clean-out plug at bottom of pool. This basin-type pool may be made any length desired and thus serve several pens. In extremely cold weather the pool should be drained each night. It is advisable to have about 2 in. of coarse gravel extending several feet back from all sides of the pool to prevent the formation of mud puddles. (*J. M. Hunter and J. C. Scholls, The Beacon Milling Company, Inc.*)

by unfamiliar sounds. Gather the eggs in wire baskets at regular intervals and place them in a cool room where the temperature is about 55°F. and the relative humidity about 60 per cent. In very cold weather use wooden buckets to gather the eggs and cover the buckets with a blanket to prevent chilling of the eggs. Clean soiled eggs at once.

3. Incubating Duck Eggs

The normal period of incubation is 28 days for the eggs of all breeds except the Muscovy, whose eggs require 33 to 35 days.

Select the eggs carefully, eliminating those of poor shape and with cracked shells. Do not hold them over 6 days because hatchability is liable to be reduced.

On the farm, duck eggs may be hatched under hens or under ducks. Provide nests in a safe place by making a slight depression in the ground or by putting an inverted sod in a box in the house and covering the soil with a thin layer of straw. Be sure the hen or duck is free of lice and see that she is fed and watered regularly. Dusting the hen with pinches of sodium fluoride will rid her of lice. Conditions of natural incubation of duck eggs are the same as for chicken and turkey eggs, except that duck eggs require more humidity. Sprinkle them with lukewarm water daily between about the fifteenth and twenty-fourth day and then again just before the ducklings are ready to pip the shell.

The artificial incubation of duck eggs requires the same conditions as chicken and turkey eggs, except for relative humidity. Best results are apparently secured with duck eggs when a relative humidity of 70 per cent or slightly higher is maintained during the first 24 days of incubation and then 60 per cent or slightly lower during the remainder of the incubation period.

Sectional-type incubators have proved popular with duckmen, apparently because of the relative ease of maintaining a satisfactory relationship between relative humidity and temperature. In sectional-type incubators, with the bulb of the thermometer 1¾ in. above the bottom of the tray, maintain a temperature of 101°F. the first week, 102°F. the second week, and 103°F. the third and fourth weeks, possibly lowering the temperature slightly at hatching time. Keep the moisture pans beneath the egg trays well supplied with water at all times. In forced-draft incubators, maintain a temperature of 99¼°F. throughout the incubation period. If you have difficulty maintaining relative humidity at a sufficiently high level, sprinkle the eggs daily with warm water.

Turn the eggs at least four times daily up to the twenty-fifth day.

Test the eggs about the fifth day, removing infertile eggs and dead embryos, and again about the twenty-fourth day to remove dead embryos. Removing dead embryos is quite important, because eggs containing them decompose rapidly and often create a strong odor.

When the ducklings begin to pip the shell, keep the incubator door closed until the hatch is well over, which may be about 2 days. Keep the ducklings in the incubator for about a day after the last ones hatched, at a temperature of about 90°F. When removing them to the brooder house, keep them from becoming chilled.

4. Rearing Ducklings

Ducklings hatched under hens or ducks are reared the same way as turkey poults hatched under hens, described in Chap. 4.

Ducklings hatched in incubators are brooded under conditions similar to those under which poults are brooded, also described in Chap. 4. Any of the regular types of brooders may be used, although on many commercial duck farms a continuous hot-water piping system is used, the pipes running the entire length of the house. From about 100 to 150 ducklings are placed in each pen of the brooder house or with each colony brooder stove, the latter usually being used on farms.

During the first week maintain a temperature of 90 to 95°F. under the hover; during the second week from 80 to 85°F.; during the third and fourth weeks from 75 to 80°F.; and from 65 to 70°F. for the rest of the brooding period. Ducklings hatched early in the season need heat for a longer time than those hatched later in the season. For the first few days use narrow boards to keep the ducklings near the hover.

Use straw or shavings for litter and clean the house every week or 10 days, replacing dirty litter.

A light bulb burning all night tends to keep the ducklings contented and reduces their tendency to pile up if any disturbance occurs. A lighted lantern may be used in place of an electric-light bulb.

Ducklings grow rapidly and must be provided with more floor space per bird at an early age. During the first 2 weeks provide about ½ sq. ft. floor space per duckling; during the third and fourth weeks provide about 1 sq. ft. per duckling; from the fifth to the seventh week provide about 2 sq. ft. per duckling; and after the eighth week provide about 3 sq. ft. per duckling.

Adequate ventilation is very important in raising ducklings. Be sure that the brooder house is well ventilated at all times.

After the first few days of brooding, allow the ducklings outdoors in fine weather. Be sure that the runway to the house or pen is fairly level so that the little ducklings can run in and out readily. Do not allow ducklings to swim and protect them from rain until the backs are well feathered, at approximately 6 weeks of age. Ducks swimming in water or standing in a rainstorm may be observed to rub the head over the base of the tail and then over the feathers of the back. At the base of the tail there is a gland, called the "uropygial gland," which contains oil. The duck preens its feathers with the apparent intent of enabling them to shed water freely. For the first 3 weeks do not allow ducklings to run in long, wet grass. Provide shade in hot weather to avoid sunstroke. If only a sandy yard is available, keep the ducklings confined during the hottest part of the day. Although a board or netting 2 ft. wide is sufficient to confine ducklings in the yard, a regular fence that is cat- and dogproof is much better.

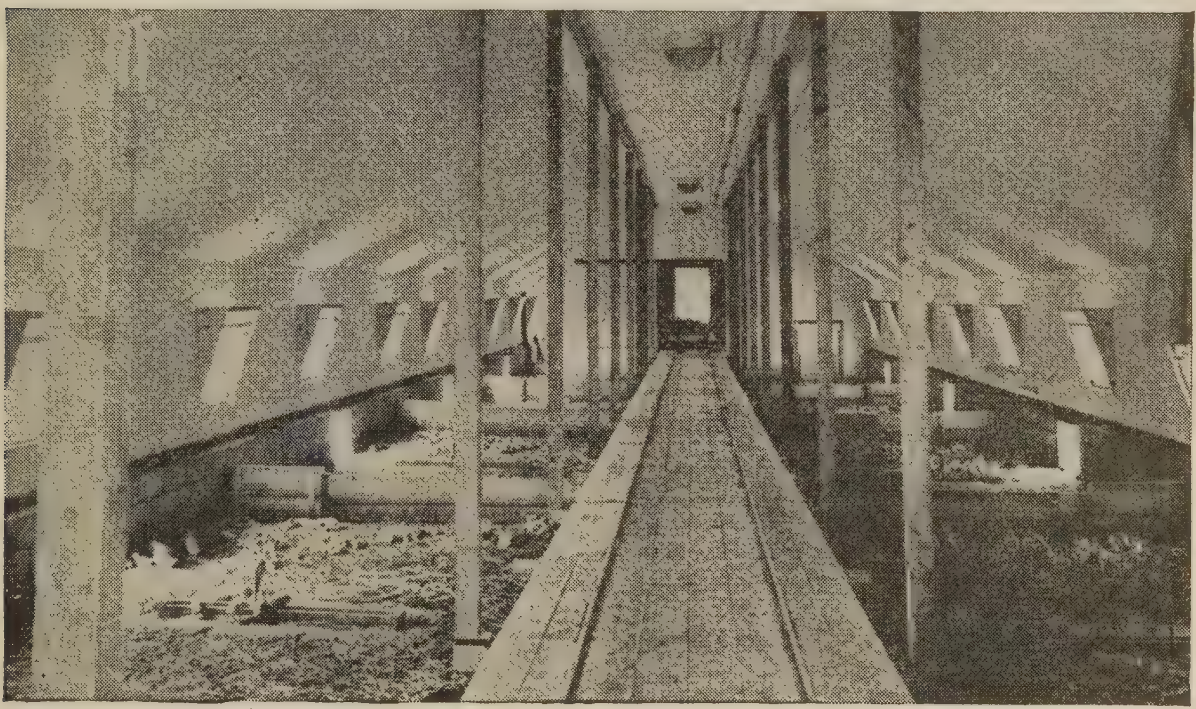


FIG. 187.—Interior of duck brooder house, showing high ceilings and boarding over heating pipes, which run the length of the brooder house. (*J. M. Hunter, The Beacon Milling Company, Inc.*)

Building Brooder Houses. Brooder houses should face south or southeast, depending upon the direction of prevailing winds, except a double brooder house with brooding pens on each side of a center aisle, which should face east and west.

Shed-roof colony brooder houses such as used for brooding chickens and turkeys are satisfactory for brooding ducklings. Long, double brooder houses on commercial plants usually have four rows of hot-water pipes running from end to end on each side of a partition through the center of the house. A platform is placed over the pipes, which tends to confine the heat under the pipes. At one end of the house the pipes are about 3 in. above the floor and toward the other end of the house the pipes continue to rise until they are about 8 in. above the floor. Ducklings are started at the end of the house where the pipes are nearest the floor and from time to time are moved further down the house, where the temperature under the pipes is lower, until at about 6 weeks usually no more heat is required and the ducklings are transferred to fattening sheds and yards.

Determining Sex. The sex of ducks is easily distinguished when the plumage is fully developed. Drakes have curled tail feathers at the base of the tails while females do not, and drakes have high-pitched voices whereas females quack, except in the case of the Muscovy. The sexes in Muscovy ducks can be distinguished at a relatively young age by the marked differences in size, drakes being much larger than females.

5. Feeding Breeders and Young Stock

The nutritional requirements of duck-breeding stock are very similar to those of chicken-breeding stock, discussed fully in "Successful Poultry Management," and of turkey-breeding stock, discussed in Chap. 5 of this book. The nutritional requirements of ducklings are very similar to those of growing chickens, discussed in "Successful Poultry Management," and of poults, discussed in Chap. 5 of this book.

Methods of feeding ducks, both adults and young stock, are somewhat simpler than those employed in feeding chickens and turkeys of different ages. For duck breeders and ducklings moist mashes are used extensively. Breeding stock is also fed a mixture of whole cereal grain, while ducklings for meat production are usually fed moist mashes exclusively, although the feeding of pellets has been on the increase during recent years. Another characteristic of duck feeding is the necessity of incorporating relatively substantial amounts of green feed in the diet, especially if the ducks do not have access to succulent green pasturage.

Feeding the Breeding Stock. Whether ducks are kept primarily for the production of eggs for market or for the production of eggs from which you secure ducklings for meat production, a high level of egg production is desirable. In the case of market-egg production, the higher the level of egg production, the fewer are the pounds of feed consumed per dozen eggs produced. In the case of egg production to obtain ducklings for meat production, the higher the level of egg production, the lower the feed cost per dozen hatching eggs and per duckling produced. Always keep in mind that the feed cost of producing duck eggs represents over one-half of the total costs of production.

Planning Diets for Market-egg Production. Runner and other laying breeds of ducks usually commence laying at about 6 months of age and if of good breeding continue laying well for approximately 1 year. The diets given in Table 76 have given satisfactory results.

TABLE 76. MASHES FOR MARKET-EGG PRODUCERS
(Nos. 1 and 2 by J. D. Bragg, Ohio Department of Public Welfare, and No. 3 by A. R. Lee, U.S. Department of Agriculture)

Ingredient	No. 1	No. 2	Ingredient	No. 3
Yellow cornmeal	45	33	Yellow cornmeal	25
Ground wheat	15	20	Low-grade flour or middlings	25
Ground oats	15	15	Wheat bran	20
Alfalfa leaf meal	7.5	8	Ground oats	15
Soybean oil meal	5	5	Meat meal or fish meal	15
Meat scrap	5			100
Meat and bone meal		10		
Dried skim milk	5	5		
Ground limestone	1	1.5		
Iodized salt	0.4	1		
Bone meal	0.6			
Cod-liver oil	1			
Fish oil (85–100 units)		1.5		
Total	100.5	100		

Note: Ten per cent alfalfa leaf meal should be added to above mixture if an abundant supply of succulent green feed is not available. Ground oystershell or limestone is fed in self-feeding hoppers.

In addition to the mashes given in Table 76, whole oats, corn, and wheat are fed in troughs or hoppers. Pellets could be used instead of a mash mixture, filling the hopper with alternate layers of pellets and whole grains in the proportion of five parts of pellets to two parts of whole grains. If mashes are fed, it is probably best to moisten them sufficiently so that a doughy mixture results and feed this mixture in troughs twice daily in quantities each time that will be eaten up within about ½ hr. Be sure that plenty of fresh drinking water is available.

From the time the breeders are selected, encourage them to take plenty of exercise by providing a good succulent range. Do not feed too much corn or other whole grains, especially if the ducks are inclined to get too fat and lazy. Rye is a good source of green feed in the spring, followed by alfalfa and oats or other cereal grasses. Rape and Swiss chard are good sources of green feed in late summer.

In Table 77 are given data on the pounds of feed consumed per dozen eggs produced by well-bred layers in a laying contest.

TABLE 77. POUNDS OF FEED CONSUMED PER DOZEN EGGS PRODUCED BY LAYING DUCKS IN AN ENGLISH LAYING CONTEST

(*Harper Adams Utility Poultry Journal*, 22 [12] p. 632)

Month of contest	Average egg production per bird	Average pounds of feed consumed per bird	Pounds of feed consumed per dozen eggs laid
1	16.6	12.19	8.83
2	18.6	11.81	7.62
3	16.9	12.19	8.65
4	18.5	11.81	7.67
5	20.1	12.26	7.30
6	20.5	12.01	7.02
7	22.3	12.24	6.58
8	22.0	12.24	6.69
9	21.5	11.62	6.49
10	20.4	12.31	7.24
11	15.5	12.38	9.60
12	10.4	11.72	13.47

It is quite evident from the data in Table 77 that laying ducks consume considerable quantities of feed. Except for the relatively short period when hatching eggs are wanted for flock-replacement purposes, the drakes should be kept by themselves. Give the layers all-night lighting.

Planning Diets for Meat Breeders. Pekin breeders kept for the production of ducklings are fed much the same as market-egg producers. As pointed out previously, the breeding stock is first selected at about 7 weeks of age. From then until the birds are housed feed them growing diets. At about 12 to 13 weeks of age they begin molting. Egg production should commence when they are about 7 months old, at which time they should be in good physical condition but not too fat.

In the case of diets Nos. 1 and 3 given in Table 78, ground oystershell or limestone is fed in self-feeding hoppers. Pellets could be fed in separate hoppers or mixed with whole grains. The practice of feeding a mixture of five parts of pellets and two parts whole grains is increasing in popularity. Keep the hoppers containing the pellets and whole grains closed except for 1 hr. in the morning and 2 hr. in the late afternoon. Be sure that plenty of clean drinking water is available at all times.

If whole oats, corn, and wheat are fed in troughs, increase the meat-scrap or fish-meal content of the mash to about 10 per cent of the diets of Nos. 1 and 2. The common practice on most duck plants is to feed the mash moistened to a sticky condition. In the morning, feed the birds as much as they will consume in about 10 min. and in the evening feed as much as they will consume in about 20 min. Provide fresh drinking water, placing the water or fountains on wire platforms to help keep the litter dry. Give the breeders access to the yards after about 9 A.M. to allow them to exercise, which is important to keep them in good physical condition.

TABLE 78. DIETS FOR PEKIN BREEDING STOCK

(No. 1, C. E. Ryan and H. J. Davis, Louisiana State University; No. 2, Poultry Council, Washington State College; No. 3, D. H. Horton, State Institute of Applied Agriculture, Long Island, New York)

Ingredient	No. 1	No. 2	No. 3
Yellow cornmeal	30	40	35
Wheat bran	20*	25	20
Wheat middlings	22†	10	
Second clear flour			12.5
Pulverized whole oats	10	10	10
Alfalfa leaf meal	5	5	5
Meat scrap	5‡	3	10
Fish meal	5	3	2.5
Dried skim milk	3		5
Ground oystershell or limestone		2	
Edible bone meal		1	
Salt		1	
Total	100	100	100

* Or rice bran. † Or rice polish. ‡ Or shrimp meal.

Planning Diets for Market Ducklings. In raising ducks for meat production, your goal should be to produce each pound gain in body weight on as few pounds of feed as possible.

Start feeding when the ducklings are first put in the brooder house and adopt a regular feeding schedule. Use shallow pans. During the first 3 weeks feed four times daily, say at 6 and 10 A.M. and at 2 and 6 P.M. For the 6 and 10 A.M. and the 2 P.M feedings, give whatever feed will be consumed within about 15 min. If any feed is left over, scrape the pans clean and put them out of reach of the ducklings, because spoiled feed is apt to cause digestive disturbances. The 6 P.M. feeding should be enough to give the ducklings all they want at that time plus a little left over for the night. An electric light or lantern left on during the night will permit the ducklings to eat and will keep them more contented. Have clean drinking water available at all times.

Beginning the fourth week, feed three times daily, giving the biggest serving at night. There is some advantage in having the water pans or fountains in the yard rather than in the house. This arrangement encourages the ducklings to take exercise and helps to keep the litter in the house dry. However, if there is no shade in the yard and the soil is sandy, ducklings are liable to suffer from the sun during the hottest part of the day. Drinking water should be available in the house during the night.

FIG. 188.—Young ducklings on a commercial duck plant. Note raised track at right of pens and boardwalk at the right of the track, making it a simple matter to transport large quantities of feed. (*U.S. Department of Agriculture.*)

Ducklings secured from well-bred stock grow rapidly, if properly fed and managed, and should be ready for market at 9 or 10 weeks of age. At that time they are known as "green ducks," a popular term in vogue on Long Island, New York, the most highly commercialized duck-producing section in the United States.

In diets Nos. 1 and 3, in Table 79, have ground oystershell available in self-feeding hoppers. These mashes could be fed in a moistened condition according to the feeding schedule outlined previously.

On a commercial duck plant, where several thousand market ducks are raised annually, a much simpler feeding program would be to feed pellets, leaving the hoppers open at all times and having a constant supply of drinking water available. Commercially prepared mashes and pellets are used extensively on large duck plants.

TABLE 79. DIETS FOR PEKIN DUCKLINGS FOR MARKET

(No. 1, C. E. Ryan and H. J. Davis, Louisiana State University; No. 2, Poultry Council, Washington State College; No. 3, D. H. Horton, State Institute of Applied Agriculture, Long Island, N.Y.)

Ingredient	No. 1	No. 2	No. 3
Yellow cornmeal	30	20	30
Wheat flour middlings	22*		20
Ground wheat		20	
Wheat bran	20†	20	10
Pulverized oats	10	5	10
Alfalfa leaf meal	5	5	5
Second clear flour		10	5
Dried skim milk	3	5	10
Meat scrap	5	5	5
White fish meal	5	5	5
Ground oystershell		2	
Bone meal		2	
Salt		1	
Total	100	100	100

* Or rice polish.

† Or rice bran.

Some duck growers feed a fattening mash beginning the eighth week, although many of the commercial duckmen feed a growing diet to marketing time. If you wish to feed a fattening diet the last 2 or 3 weeks, you might try a mixture similar to any of those given in Table 80. Growing ducks selected for breeding purposes at 7 weeks

TABLE 80. FATTENING DIETS FOR MARKET DUCKS

(No. 1, D. H. Horton, State Institute of Applied Agriculture, Long Island, N.Y.; No. 2, A. R. Lee, U.S. Department of Agriculture; No. 3, C. E. Ryan and H. J. Davis, Louisiana State University)

Ingredient	No. 1	No. 2	Ingredient	No. 3
Yellow cornmeal	50	50	White cornmeal	50
Wheat bran	15	18	Rice bran	20
Flour	12.5	13	Wheat shorts	20
Ground oats	10	5	Pulverized oats	5
Green feed		10	Meat scraps	5
Meatmeal	5	12		
White fish meal	2.5			
Dried skim milk	5	2		
Total	100	110	Total	100

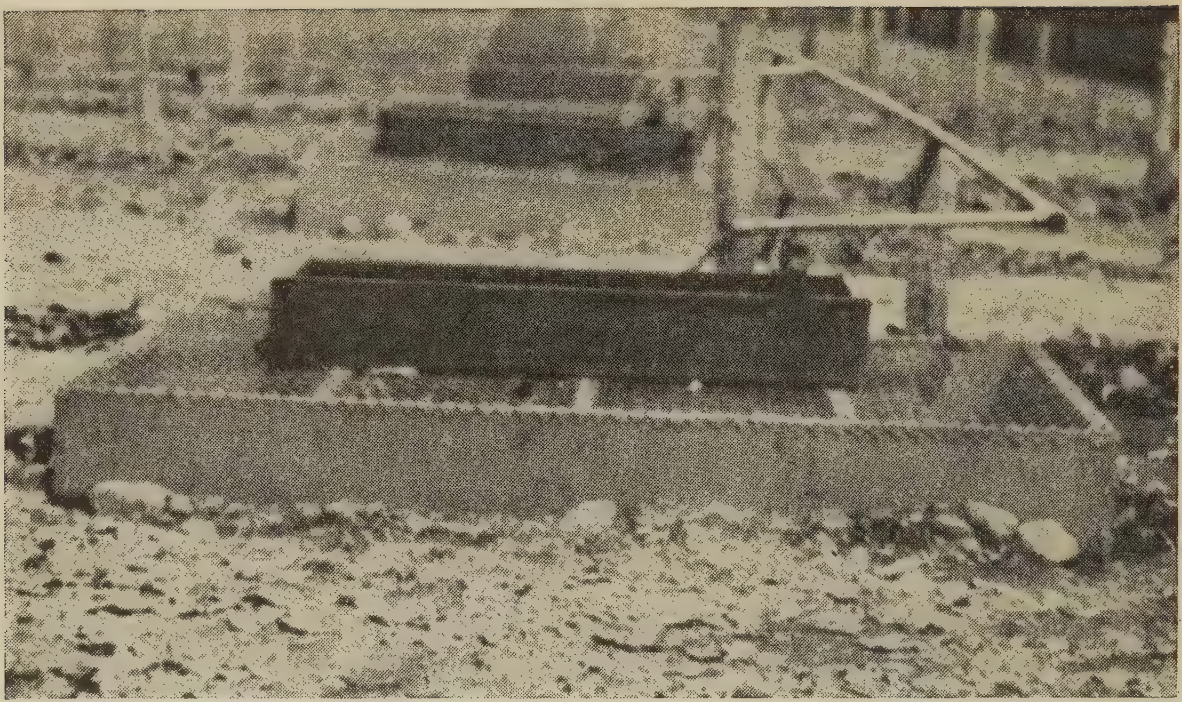


FIG. 189.—A practical system for watering ducks on farm of Guild Brothers in Massachusetts. This system is satisfactory for in or out of doors. The screened platforms prevent the ducks from burrowing around the troughs. If used in houses, the platform should be set in a pit about 8 in. deep, leaving the height of the platform a few inches above the level of the floor, so that any water spilled through the screen will be well below the surface of the litter on the floor. The automatic control of water makes possible the use of small troughs because the water is always at the same level. Ducks are always assured of a supply of fresh, clean water to drink—a very important factor in duck management. (*J. M. Hunter and J. C. Scholls, The Beacon Milling Company, Inc.*)

of age should be continued on a growing diet but other ducks could be switched to a fattening diet.

Feeding mash mixtures in pellet form saves much labor on a large duck plant as compared with hand-feeding moist mashes.

Comparing Growth with Feed Consumption. Well-bred Pekin ducklings grow rapidly and eat quantities of feed. They grow considerably faster than Runner ducklings during the first 12 weeks, as the data in Table 81 show. Pekin ducklings consume more feed than Runner ducklings but utilize feed more efficiently in making gains in body weight.

The most rapid period of growth in ducklings is during the first 6 weeks, but well-bred Pekin ducklings make economical gains during the first 9 or 10 weeks. Under proper conditions flock averages of over 6 lb. are readily obtainable, as indicated in Table 81.

From the data in Table 81 you can determine the approximate number of pounds of feed required to raise ducklings up to a certain

FIG. 190.—On this commercial duck plant, a horse and wagon are used to transport feed to the ducks. (*U.S. Department of Agriculture.*)

age or weight. If you have good Pekins, they should be able to attain an average weight of about 5¾ lb. on about 20 lb. of feed by 9 weeks of age and about 6½ lb. on about 23 lb. of feed by 10 weeks of age.

TABLE 81. RATE OF GROWTH, FEED CONSUMPTION, AND AVERAGE POUNDS OF FEED PER POUND OF BODY WEIGHT IN PEKIN AND RUNNER DUCKLINGS
(Dominion Experimental Farms, Ottawa, Canada)

Age, weeks	Pekin			Runner		
	Average weight per bird, pounds	Average pounds feed per bird	Average pounds feed per pound gain in weight	Average weight per bird, pounds	Average pounds feed per bird	Average pounds feed per pound gain in weight
0	0.12			0.09		
1	0.32	0.43	2.15	0.20	0.25	2.17
2	0.77	1.48	2.28	0.37	0.77	2.75
3	1.60	3.06	2.07	0.81	1.52	2.11
4	2.60	5.35	2.15	1.30	2.77	2.29
5	3.42	7.88	2.39	1.80	4.19	2.45
6	3.85	10.55	2.83	2.24	5.75	2.67
7	4.74	13.55	2.93	2.66	7.34	2.86
8	5.44	16.21	3.05	2.93	9.24	3.25
9	5.77	19.20	3.40	3.22	11.24	3.59
10	6.51	22.73	3.56	3.66	13.37	3.74
11	6.78	26.33	3.95	3.85	15.49	4.09
12	7.50	29.82	4.04	4.09	17.78	4.45

As ducklings increase in age, more pounds of feed are consumed per pound of gain in weight. Based on the data given in Table 81, it has been determined that for each 3-week period the number of pounds of feed per pound of gain in weight in the case of Pekin ducklings is as follows:

Period, in weeks	0–3	4–6	7–9	10–12
Pounds of feed per pound gain in weight	2.07	3.33	4.50	6.14

It is apparent, therefore, that it is in the duck grower's interest to market his ducks as soon as they reach prime market condition. If green ducks are not marketed when in prime condition they are liable to molt and lose weight. Most commercial duck producers count on marketing about 60 green ducks per breeder kept.

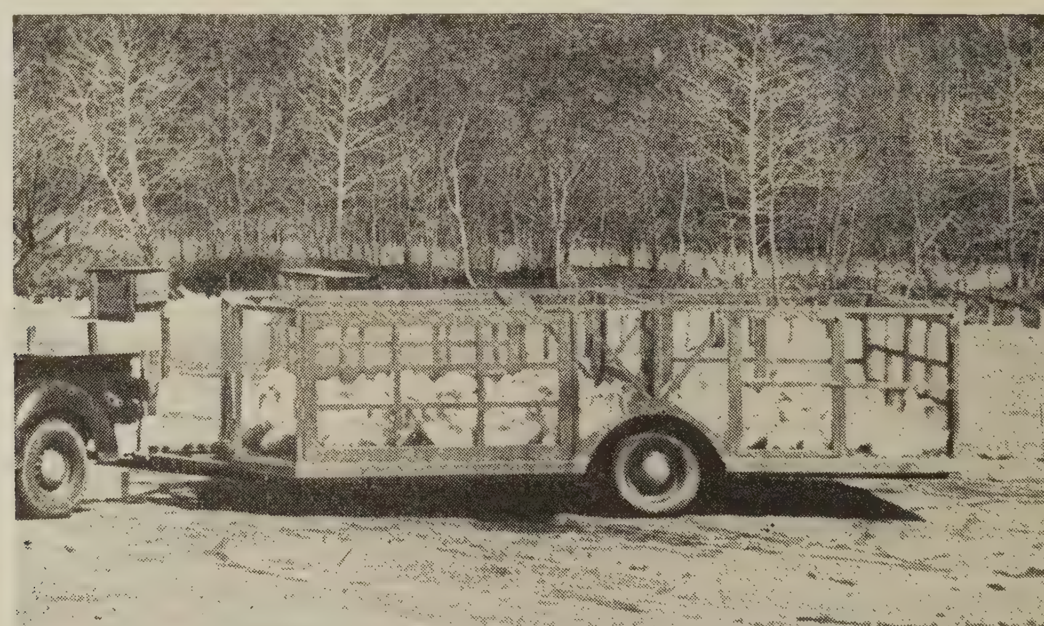


FIG. 191.—A trailer for moving ducks on the Massachusetts farm of D. J. Hayes. There are two sections, the side panels of the front section and the rear panel of the rear section being hinged at the bottom and opening outward to form ramps for driving the ducks onto the trailer. (*J. M. Hunter and J. C. Scholls*, *The Beacon Milling Company, Inc.*)

6. Marketing Ducks, Feathers, and Eggs

Ducks are marketed alive, dressed, and eviscerated, depending upon circumstances. Most farmers sell their surplus ducks in the fall of the year, since farmers, for the most part, do not specialize in the growing of green ducks. Although most of the farm-raised ducks are sold alive at farmers' markets in towns and cities, quite a few farmers sell either dressed or eviscerated ducks on the market or direct to consumers. Practically all commercially produced green ducks are sold either dressed or eviscerated.

When catching ducks, either for killing or crating, pick them up by the neck and not by the feet or wings. Grasp the duck gently under the jaw so that when the duck is lifted off the ground its weight is suspended by your thumb and forefinger under each jaw, the palm of your hand surrounding the back of the neck just below the head.

When ducks are marketed alive from the farm in the fall of the year, it is difficult for some people to distinguish the young ducks from

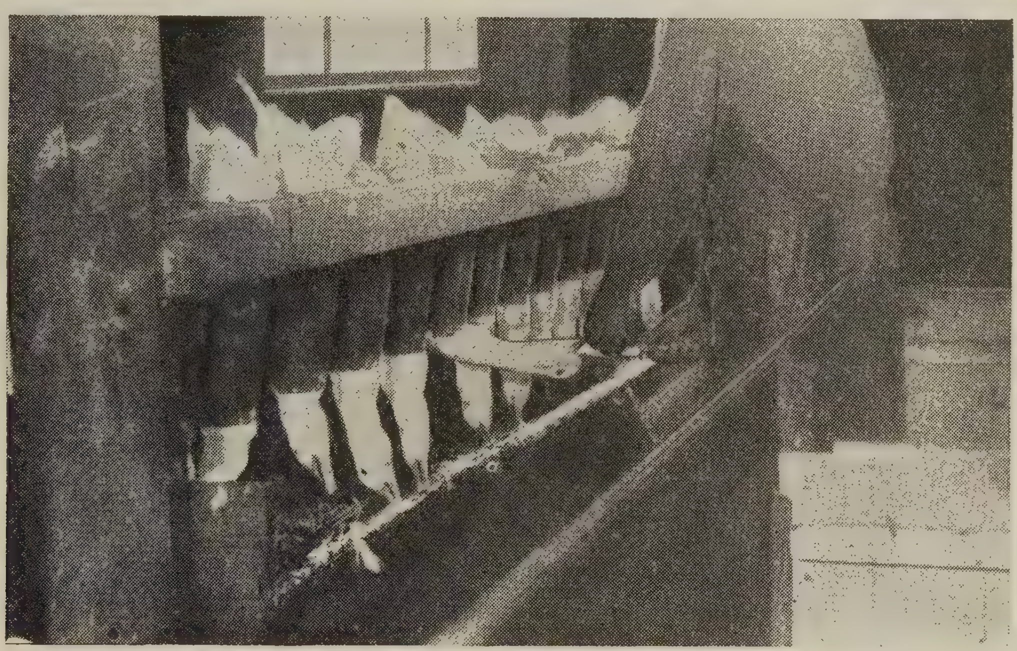


FIG. 192.—Funnels for killing ducks on farm of Phillip S. Gordon, Long Island. Each funnel is 12 in. high, 8 in. in diameter at top and 2⅛ in. in diameter at bottom. (*J. M. Hunter and J. C. Scholls, The Beacon Milling Company, Inc.*)

the old ones. If the windpipe feels soft, the duck is a young one but if the windpipe feels hard, the duck is an old one.

Killing and Dressing Ducks. When ducks are to be killed, withhold feed for at least 12 hr. prior to killing. Suspend the bird by the feet and as soon as it has been stuck, attach a blood cup to the bill to hold the head down and permit good bleeding. For sticking, use a knife about 4 in. long. A more convenient method of killing is to place each bird head downward in a metal funnel with the head and neck protruding through the small end of the funnel. This prevents wing flapping.

Just as soon as bleeding is completed, commence plucking or the dressed carcass is liable to be discolored. Ducks are plucked either dry or after being scalded. Scalding in water just below the boiling point makes plucking easier. If the water is not hot enough, plucking is almost as difficult as dry plucking. If the water is too hot or the ducks are left in too long, the skin is very likely to be torn. Immerse each duck separately by holding it by the head and feet, lowering the body into the water, and moving it backward and forward a few times. By testing a few feathers for ease of plucking in the first few trials, you will soon learn the proper way to scald ducks.

Fig. 193.—Plucking ducks mechanically on farm of D. J. Hayes, Massachusetts. Rough plucking is done on the two dry-plucking machines in the foreground, a blower being attached to each machine to blow the feathers to the feather-holding room upstairs. The balance of the plucking is completed on the mechanical plucker in the left background, this machine being equipped with rubber fingers. (*J. M. Hunter and J. C. Scholls, The Beacon Milling Company, Inc.*)

When plucking is completed, remove any pinfeathers with a small knife after plunging the bird into the scalding water and removing it quickly. Wash dirt off the feet with a damp cloth. Remove blood from the bill and blood stains on the head. Squeeze the vent to remove any feces. Singe the birds over an alcohol flame or with a candle.

Some commercial dressing plants use mechanical pluckers. Molten wax is employed in many plants in the same manner as for plucking turkeys, described in Chap. 7. See also the discussion on dressing chickens in "Successful Poultry Management."

Chilling Dressed Ducks. As soon as the ducks are plucked, cool them thoroughly in tubs, barrels, or vats of clean, cold water. In large plants, where many ducks are dressed at a time, two sets of vats are used for chilling in order to remove the body heat as quickly as possible. After a part of the body heat is removed in the first vat, the ducks are transferred to the second vat, which is usually larger than the first one. In the second vat the ducks are placed breasts down in layers, with cracked ice between layers, and a blanket is spread over the top layer of ice to keep out warm air. The ducks are left in the second vat until they are thoroughly chilled and the flesh is quite firm.

Grading Dressed Ducks. In grading dressed ducks for market, they are first classed as young or old. Young ducks are soft-meated ducks of either sex in which the bills are not completely hardened and the windpipes are easily dented. Old ducks are mature ducks of either sex, with toughened flesh, hardened bills and windpipes.

The quality specifications for individual birds for tentative U.S. standards for grades for *dressed ducks* are as follows, except for age the specifications for each grade being the same:

U.S. Grade A: full-fleshed bird of either sex, well dressed, and free of deformities.

U.S. Grade B: well-fleshed bird of either sex, free of deformities, or full-fleshed bird with slight deformities, blood spots, or slight dressing defects.

U.S. Grade C: edible bird of either sex inferior to U.S. Grade B.

Any bird of the quality of U.S. Grade A or U.S Grade B from which the feathers have not been completely removed will be lowered one grade. Pluck ducks clean! Dirty feet, dirty vents, and dirt or blood on heads will lower birds that otherwise would qualify as U.S. Grade A or U.S. Grade B to a lower grade.

The tentative U.S. wholesale grades for *dressed ducks in packages* are as follows:

U.S. Grade A: a lot of dressed ducks consisting of three or more wholesale packages shall contain not less than 90 per cent birds of the quality of U.S. Grade A, the balance to be of the quality of U.S. Grade B and with no individual package in the lot containing more U.S. Grade B birds than in the proportion of 2 in 12. In a lot consisting of one or two wholesale packages, the tolerances for individual packages mentioned above may apply to each package.

U.S. Grade B: a lot of dressed ducks consisting of three or more wholesale packages shall contain not less than 90 per cent birds of the quality of U.S. Grade B, the balance to be of the quality of U.S. Grade C and with no individual package in the lot containing more U.S. Grade C birds than in the proportion of 2 in 12. In a lot consisting of one or two wholesale packages, the tolerances for individual packages mentioned above may apply to each package.

U.S. Grade C: all birds shall be of the quality of U.S. Grade C or better, no birds obviously unfit for human food being permitted.

Fig. 194.—Packing dressed ducks in barrels on farm of H. F. Corwin and Son, Long Island. (*J. M. Hunter and J. C. Scholls, The Beacon Milling Company, Inc.*)

Packing Dressed Ducks for Market. Dressed ducks are packed in barrels or boxes, the latter being preferable.

When barrels are used, place a layer of crushed ice in the bottom of the barrel; then a layer of ducks, breasts down, and so on until the barrel is nearly full. Place a thick layer of crushed ice over the top layer of ducks and secure a burlap covering under a hoop around the top of the barrel.

The use of boxes for packing dressed ducks has increased during recent years, no ice being used. Quick-freezing dressed and eviscerated ducks is practiced extensively. The popular size of box is one containing 12 ducks, in two layers of two rows of three ducks each.

Pack U.S. Grades A and B dressed ducks according to the following weight specifications:

Weight range per bird		Weight range per dozen birds	
Minimum	Maximum	Minimum	Maximum
None	3 lb. 15 oz.	None	47 lb. 15 oz.
4 lb.	4 lb. 15 oz.	48 lb.	59 lb. 15 oz.
5 lb.	None	60 lb.	None

All birds of the quality of U.S. Grade C may be packed together regardless of weight.

FIG. 195.—The evisceration and inspection section of The Long Island Packing Corporation, Long Island. (*J. M. Hunter and J. C. Scholls, The Beacon Milling Company, Inc.*)

Eviscerating Dressed Ducks. Selling eviscerated ducks, ready for the oven, has increased considerably during recent years. In commercial dressing plants the evisceration process is carried out in the same manner as described for chickens in "Successful Poultry Management" and as for turkeys in Chap. 7 of this book.

Getting Ducks on the Market. Duck prices, whether for live or dressed birds, are relatively high from December through March or April and are usually lowest during the midsummer months.

Commercial producers of green ducks hatch ducklings the year round but aim to have their largest hatches arrive at such times that the ducks will be in prime market condition when market prices are at their best.

Marketing Duck Feathers. Duck feathers are a valuable by-product of the duck industry and every precaution should be taken to save them. The average yield of feathers is about 4 oz. per duck. White feathers are preferred to colored ones. If you dry-pluck your

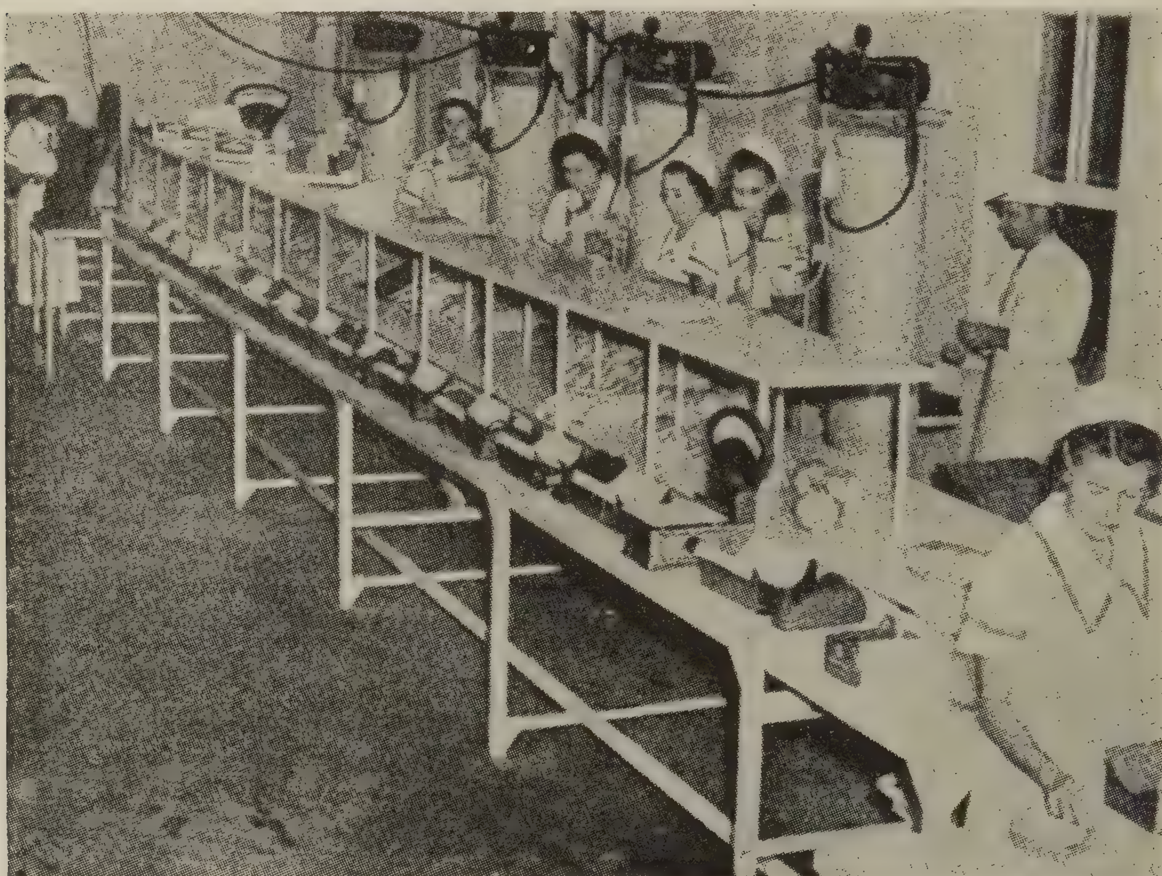


FIG. 196.—The packing section of The Long Island Packing Corporation, Long Island, N. Y. (*J. M. Hunter and J. C. Scholls, The Beacon Milling Company, Inc.*)

ducks, keep the feathers clean and as free of blood and other foreign matter as possible. At plucking time put them in coarse burlap sacks and hang them up in a dry place to dry out thoroughly. On commercial duck farms and at poultry dressings plants, where hundreds or thousands of ducks are killed at one time by the scald-plucking method, the feathers are washed thoroughly and then dried in special drying machines.

Marketing Duck Eggs. The consumption of duck eggs has not assumed so important a role in the United States as it has in England, Holland, and other European countries. In the United States, the demand is relatively greatest during the Lenten period, especially among the foreign-born population of the larger cities. Duck eggs usually have a somewhat stronger flavor than chicken eggs and consequently are not so popular for serving on the table but are used extensively in baking and making various culinary products.

Duck eggs are inclined to spoil quicker than chicken eggs unless kept under the best of conditions and, therefore, should be marketed at frequent intervals. In warm weather gather them every hour in wire baskets, wash the dirty ones immediately, and store them in a

FIG. 197.—Box-packed eviscerated ducks, quick-frozen by the Z Process method. (*J. M. Hunter and J. C. Scholls, The Beacon Milling Company, Inc.*)

room having a temperature of about 55°F. and a relative humidity of about 60 per cent.

Duck-egg prices show seasonal variation quite different from chicken-egg prices. Whereas chicken-egg prices are highest in the fall of the year and lowest in the spring, duck-egg prices are relatively high just before Easter and again in the fall, the peak prices in the spring usually being higher than the peak prices in the fall. Immediately prior to the Easter season, duck eggs are much higher in price than chicken eggs, but for the rest of the year duck-egg prices are considerably lower than chicken-egg prices, especially during the summer months.

From 1937 to 1941, inclusive, the average annual price of duck eggs was 29.3 cents per dozen, the highest monthly price of 39.5 cents being paid in March and the lowest monthly price of 22.1 cents being paid in June.

7. Controlling Duck Diseases

Ducks are subject to fewer diseases than chickens and turkeys, but occasionally a particular disease may cause very heavy losses among flocks of ducklings and less frequently among flocks of breeders. Certain diseases of turkeys, described in Chap. 6 of this book, also affect ducks; some of the more important of these diseases include botulism, fowl cholera, Leucocytozoon disease, and paratyphoid, which need not be discussed further here. Other diseases of particular significance in raising ducks are discussed briefly.

Anatipestifer Infection. This is a highly infectious disease of young ducks caused by *Pfiefferella anatipestifer*. The disease is acute, death frequently occurring within 6 to 12 hr. after the first symptoms are noticed. A sleepy attitude, ruffled feathers, and severe diarrhea with greenish discharge are among the first symptoms of the disease. Infected birds are soon unable to stand, jerk their heads continuously, have a serous discharge from the eyes, and finally lie prostrate.

Upon autopsy, a yellowish exudate is found to cover the liver, heart, and outer surface of the intestinal tract. The spleen is usually enlarged and is mottled brown and white. The lungs and kidneys are usually congested. In order to diagnose the disease positively, a bacteriological examination is essential. There is no known method of treating the disease, but rigid sanitation and killing infected birds as soon as they are noticed constitute the most effective methods of controlling the disease.

Brooder Pneumonia. Ducklings that are overcrowded in the brooder house or allowed to become chilled often develop watery eyes, wheezy breathing, and swellings on the sides of the head. Preventive measures include: avoid overcrowding the brooder house; maintain proper brooder temperatures; provide adequate ventilation of the brooder house. Use one teaspoonful of baking soda per quart of drinking water for about 12 hr.; it may help to alleviate the trouble.

Diarrhea. This digestive disturbance among ducklings sometimes results from chilling, overheating, or drinking too much ice-cold water. Watery droppings and smearing down around the vent are the usual symptoms. Preventive measures are to avoid the causes mentioned. If ducklings develop diarrhea, give a teaspoonful of baking soda per quart of drinking water for 1 day and repeat in 2 or 3 days, if necessary. Clean out the brooder house after each treatment.

Preventing Diseases from Appearing. Some duck growers never seem to learn that "an ounce of prevention is worth a pound of cure." Preventing diseases from appearing saves much trouble and sometimes a lot of money. Strict sanitation is the best prevention against losses from disease. Do not overcrowd the brooder houses and keep the houses and yards in a sanitary condition at all times. Thorough disinfection of the houses after they are cleaned is absolutely essential. Keep the feeding and watering utensils clean at all times. Practice regular cultivation of the yards and grow a green crop whenever possible.

SUMMARY

1. For meat production, Pekins are best. For egg production try Runners or Khaki-Campbells.
2. In developing a good meat-producing strain, select future breeders from among ducklings at about 7 weeks of age and again before any are marketed.
3. In developing a market-egg-producing strain, select future breeding stock from families secured from outstanding dams and sires.
4. Locate the house for breeding stock on well-drained soil and have the floor level and at least 6 in. above outside ground level.
5. Incubation conditions for duck eggs are practically the same as for turkey eggs, except for duck eggs provide a relative humidity of 70 per cent during the first 24 days and about 60 per cent during the last 4 days.
6. Satisfactory brooding temperatures are: first week 90 to 95°F.; second week, 80 to 85°F.; third and fourth weeks, 75 to 80°F.; and for the rest of the brooding period, 65 to 70°F.
7. Keep a light bulb burning all night in the brooder house.
8. Allow about ½ sq. ft. of floor space per duckling at first and gradually increase this area to about 3 sq. ft. at eighth week.
9. During first 3 weeks feed ducklings four times daily.
10. Ducks marketed at about 10 weeks are called "green ducks."
11. Pluck ducks very carefully to avoid tearing the skin.
12. Save duck feathers and dry them for market.

10. Raising and Marketing Geese

GOOSE raising in the United States had its beginnings with the arrival of the early settlers from European countries where goose raising has been practiced for centuries. The industry did not develop rapidly, however, probably because of the relative abundance of wild ducks and wild geese, as well as other game, in the early colonial days.

As the country became settled and farms were hewn out of the wilderness, farm flocks of geese were established. Then, as the cities grew, commercial goose farms were started. As early as 1800 commercial goose raising had become an important enterprise in Connecticut, Massachusetts, and Rhode Island, especially in the Little Compton section of Rhode Island. The industry prospered for approximately 100 years and then began to give way to other enterprises, including chicken-egg and chicken-meat production. At the same time, farm and commercial goose raising gradually extended to other parts of the country, especially in the vicinity of towns and cities having a large foreign-born population. Most of the geese raised annually in the United States are now produced in the Middle West, Wisconsin being an important goose-producing state; here the practice of fattening geese by special methods is carried on extensively. Raising and marketing geese are presented in connection with the following major activities:

1. Choosing Breeds
2. Selecting and Mating Geese
3. Incubating Goose Eggs
4. Rearing Goslings
5. Feeding Geese
6. Marketing Geese, Feathers, and Eggs
7. Controlling Goose Diseases

1. Choosing Breeds

The problem of choosing a breed for the most economical production of meat, which is the primary purpose for which geese are raised, is fairly simple. There are only seven standard-bred breeds recognized by the American Poultry Association. Three breeds are particularly well adapted for meat production because of their large size; three breeds are of medium size; one breed is almost exclusively an ornamental breed.

Before discussing breeds of geese, however, it is well to become familiar with the different parts of a goose. Figure 198 shows these different parts, especially those of the plumage.

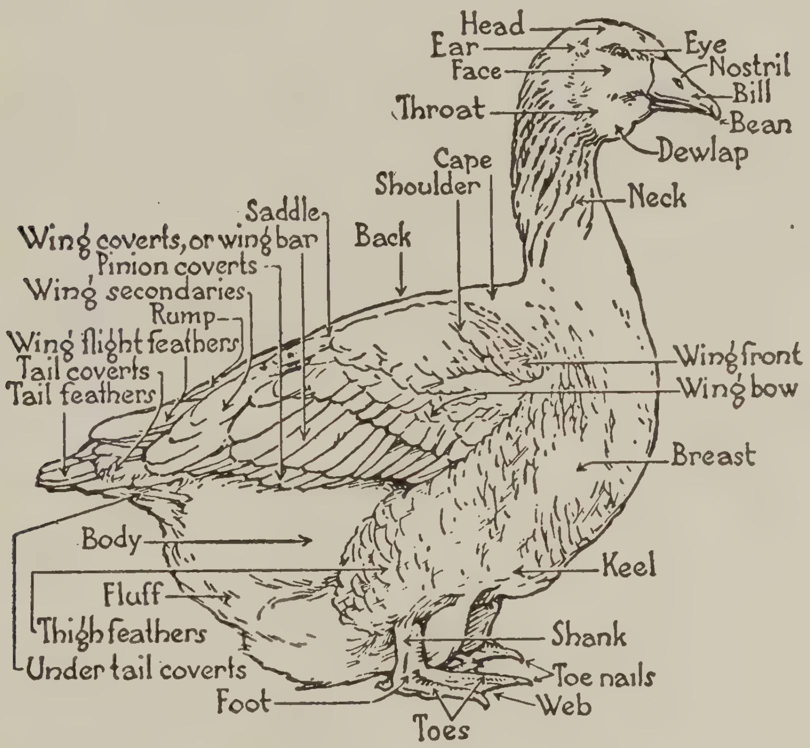


FIG. 198.—The parts of a goose, with special reference to the plumage. (*From "Fowls of Forest and Stream Tamed by Man" by Morley A. Jull, courtesy of The National Geographic Magazine, March,* 1930.)

Identifying Breeds. The seven breeds recognized as standard-bred are Toulouse, Embden, African, Chinese, Canada, Egyptian, and Sebastopol. All the breeds except the Canada and Egyptian are descended from the Wild Graylag goose. The summer range of the Wild Graylag goose is from Iceland, Finland, and Kamchatka to the Caspian and Black Sea districts, while its winter range includes Central Europe to India and China. The Canada goose ranges as far north as Alberta and Saskatchewan in the summer and as far south as the southern half of the Mississippi Valley, west of the Mississippi River. The Egyptian goose ranges over most of Europe and breeds in England and Scotland as well as farther south.

Toulouse. In the early part of the nineteenth century large gray geese were being bred extensively in the Toulouse district in France.

They came to be known as Toulouse geese. This breed is probably the most popular one in the United States. The bill is pale orange and the shanks are reddish orange.

Embden. This pure-white breed is very popular, not only because it is excellent for meat production but also because of its white feathers. The bill and shanks are orange-colored.

African. The color of the plumage of the African is for the most part ashy brown. The bill is black and the shanks are dark orange. One of the outstanding characteristics of this breed is the presence of

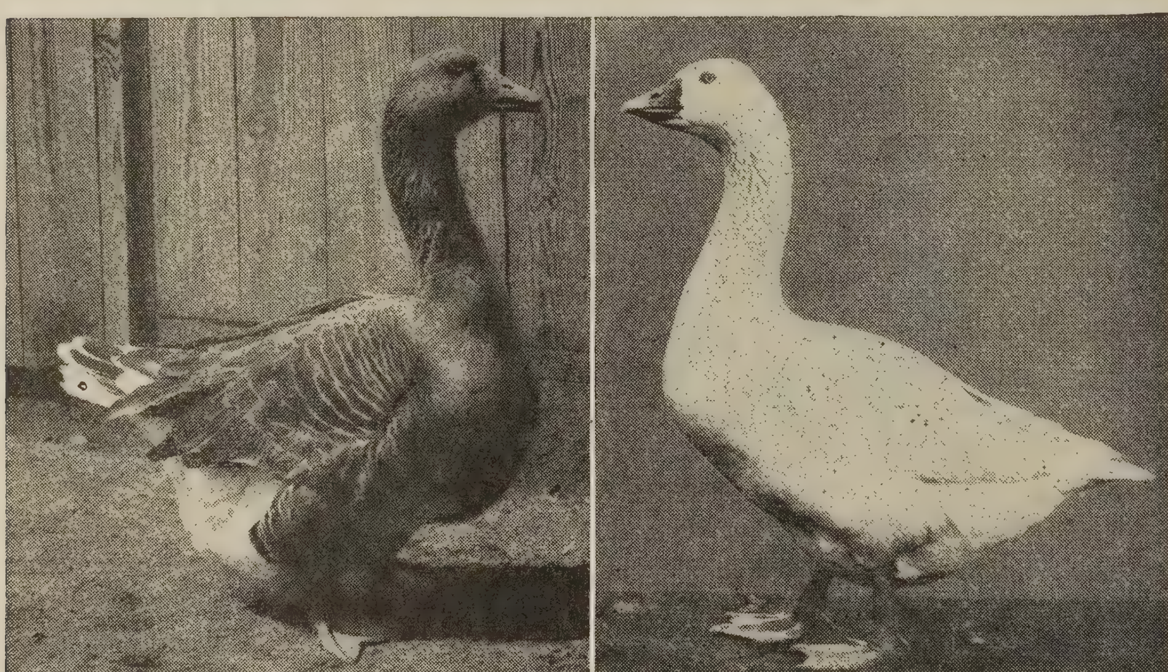


FIG. 199.—Left, Toulouse gander. Right, Embden gander. (*U.S. Department of Agriculture.*)

a well-developed knob at the base of the bill. There is also a prominently developed fold of pendulous skin, called the "dewlap," under the throat.

Chinese. This breed is more upstanding than other domestic goose breeds and, like the African, has a knob at the base of the bill and a dewlap under the throat. There are two varieties, the Brown and the White. The Brown variety has russet-brown plumage for the most part. The bill is black or dark slate and the shanks are orange. The White variety has an orange bill and orange-yellow shanks.

Canada. The head of this breed is black with white markings on each side of the face, and the neck is black. The plumage over most of the body is dark gray, except that the underpart of the body is white and the tail is black. The bill and shanks are black.

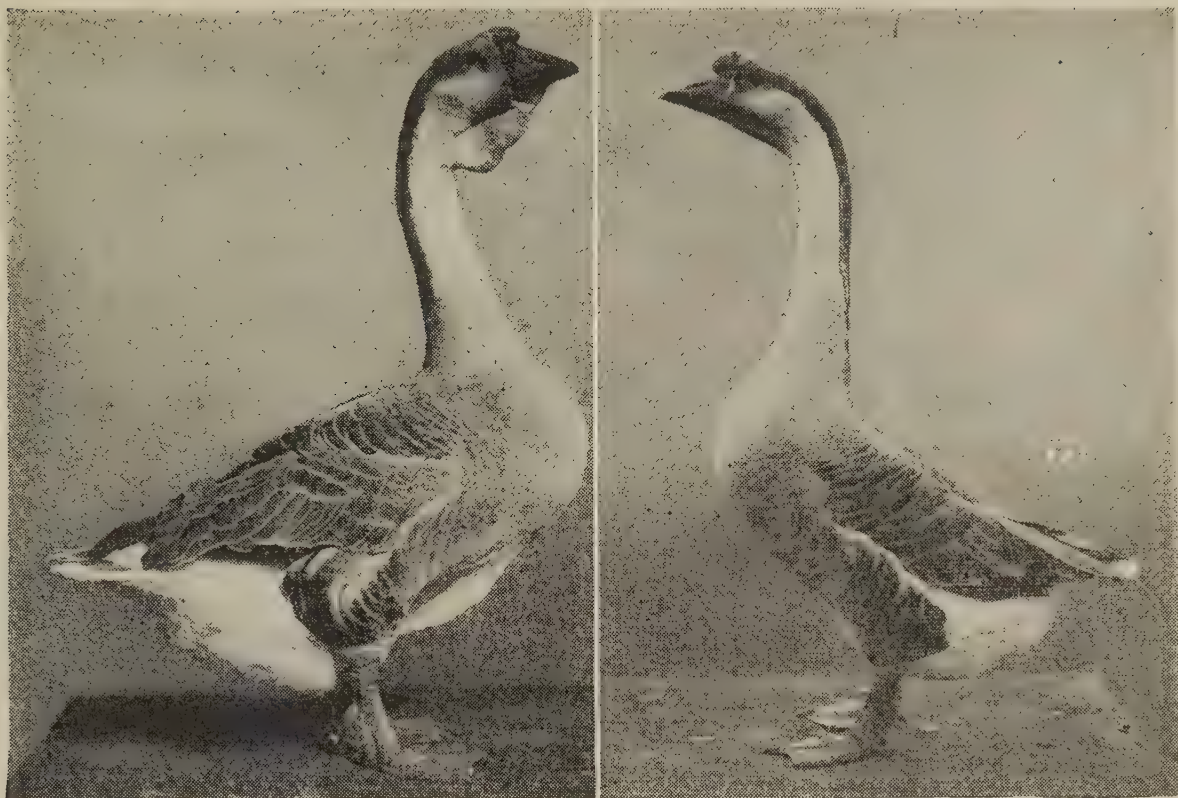


FIG. 200.—Left, African gander. Right, Brown Chinese gander. (*U.S. Department of Agriculture.*)

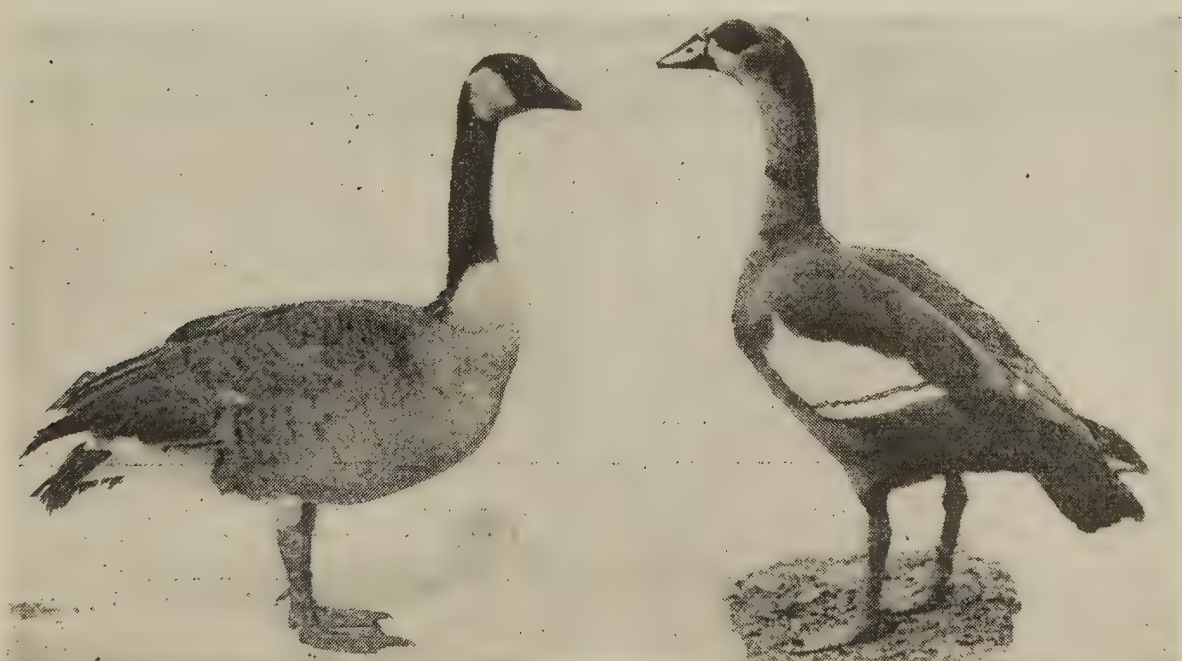


FIG. 201.—Left, Canada gander. Right, Egyptian gander. (*U.S. Department of Agriculture.*)

Egyptian. This is a very attractive looking bird with parti-colored plumage. The head is gray with a reddish-brown patch around the eyes. There is a ring of black around the neck. The back is gray and black and the shoulders are white with a narrow black stripe.

The tail is black. The center of the breast is reddish brown and the rest of the breast is gray. The bill is reddish purple and the shanks are reddish yellow.

Sebastopol. This is largely a novelty breed, inasmuch as the primaries and secondaries and main tail feathers are much curled and twisted and the feathers over the back are also much curled. The plumage is white and the bill and shanks are orange-colored.

FIG. 202.—Sebastopol geese.

Comparing Weights. Since geese are raised primarily for meat, although feathers are important, the choice should be a breed that has been bred for rapid growth and efficient meat production. The following standard weights, in pounds, of the different breeds indicate which breeds are best adapted for meat production.

Breed	Adult gander	Adult goose	Young gander	Young goose
Toulouse	26	20	20	16
Embden	20	18	18	16
African	20	18	16	14
Chinese	12	10	10	8
Canada	12	10	10	8
Egyptian	10	8	8	6
Sebastopol	14	12	12	10

It is quite apparent from the standard weights given above that the Toulouse, Embden, and African breeds are best suited for meat-production purposes, although the standard weights of the adults are higher than desirable for best results in breeding. These three breeds have been bred for rapid growth and flesh development to a greater extent than any of the others. Most of the farm flocks in the United States have infusions of Toulouse or Embden blood. More of them would probably be more profitable if they were substituted by purebred flocks.

2. Selecting and Mating Geese

The first step in selecting and mating geese is to know how to distinguish the sexes, because to all outward appearances the males and females resemble each other closely. The gander has a high, shrill voice, while the female goose has a harsh, coarse cry. Very often, however, the ganders and females will not utter sounds sufficiently loud enough to enable one to distinguish the sexes, especially when they are being handled. The gander is usually larger than the female of the same age and has a slightly longer neck and larger head. If all other measures of distinguishing the sexes fail, the sex of each mature bird may be determined by examining the sexual organs just preceding or during the breeding season. Have each bird held flat on its back. In the female, the sphincter muscle which closes the anus appears folded if stretched. In the male, slight pressure around the anus usually results in the sexual organ being protruded.

The best age for breeding is from the third to the fifth year in the case of both ganders and females. Yearling ganders may be used, however, especially if they are well-matured specimens. Females sometimes lay the first year, but goslings secured from these eggs should not be kept for breeding purposes. Females may be kept for 8 to 10 years, but ganders should not be kept after about 6 years. To distinguish the age of geese, feel their windpipes; a soft one indicates a young bird and a hard one an old bird.

Since geese are raised almost entirely for meat production, with feathers and eggs of secondary importance, select ganders and females that are noted for rapid growth and good body size. Select your future breeding stock from progeny produced by breeders that are from 3 years old or older. While good body size in market geese is very desirable, it is well to select ganders and females for breeding purposes that are not too large.

Make up matings in the fall of the year. A gander may be mated with up to five females, but a mating of one gander and two or three females usually gives better results. Canada geese practically always mate in pairs. After the matings have been made up for some time, all of the matings may be allowed together or each mating may be kept separate from the others during the breeding season to prevent the ganders from fighting. As a rule, geese mate for life and it is sometimes difficult to remate them. In yards of good size, a fence about 3 ft. high will keep the geese confined. Have good pasture available to breeders.

Provide an open shed or some kind of shelter for the breeding stock, especially in northern sections of the country. This gives the geese protection against stormy weather and encourages earlier laying. Keep plenty of clean straw or shavings on the floor. In southern

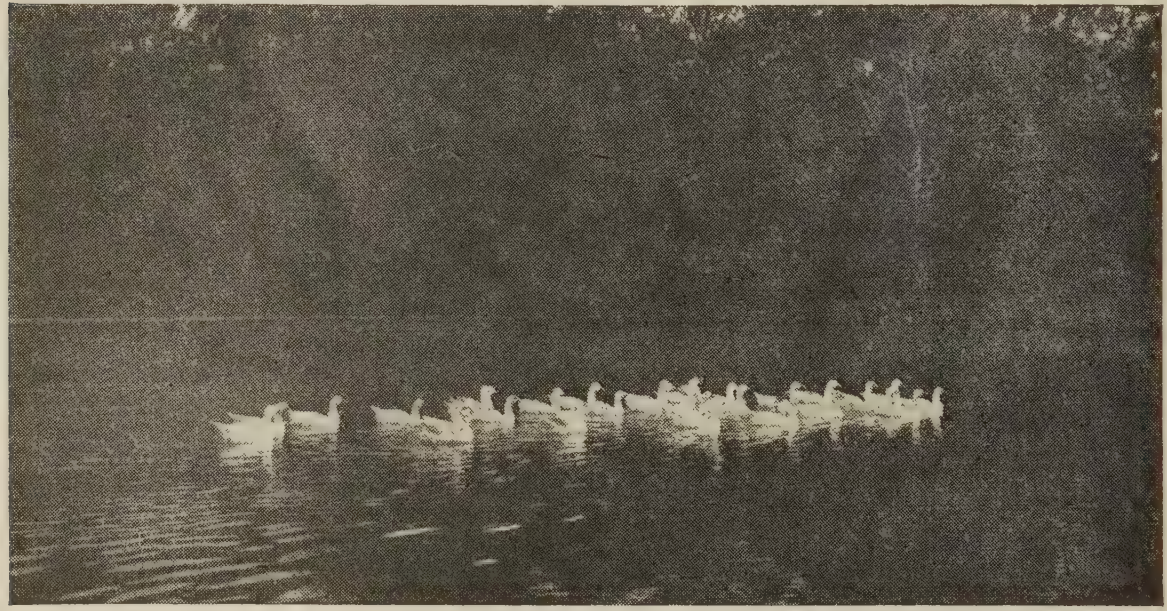


Fig. 203.—Accessibility to water tends to increase fertility in breeding stock. (*U.S. Department of Agriculture.*)

sections of the country a shelter of some kind is desirable to give geese protection against the heat. In fact, in all parts of the country geese must be protected from the hot sun.

Allow the geese to make nests on the floor or provide boxes or barrels. Removing the eggs from the nest daily tends to stimulate further laying. If a female goes broody and you do not want to set eggs under her, put her in a coop with a slat or wire bottom and give her plenty to eat and drink.

Well-bred females will lay upward of 50 or 60 eggs each laying season during the third to fifth years, Chinese females often laying more than the females of other breeds. Breeding for earlier laying and higher egg production should be the goal of all goose breeders.

It is economical to use ganders that will mate readily with several females.

3. Incubating Goose Eggs

Gather the eggs every day. Store them in a room at a temperature of about 55°F., not too dry, such as in the cellar. Do not hold eggs over 10 days.

The incubation period in the smaller breeds of geese is about 30 days and in the larger breeds about 32 or 34 days. The eggs may be incubated under hens or geese or in incubators.

Some goose raisers prefer to use hens because geese are sometimes rather hard to manage; however, on most farms the geese are allowed to incubate their own eggs and raise their goslings. Set from four to six eggs under a hen, depending upon her size and the size of the eggs. Embden and Toulouse eggs are considerably larger than Chinese and other small-breed eggs. Set the hen in a quiet place where she will not be molested and provide feed and clean water daily. Rub a few pinches of sodium fluoride into the feathers over different parts of the body, especially around the vent, to rid the hen of lice. Apply again in about 10 days to kill lice hatched after the first treatment. *Goose eggs under hens must be turned by hand daily.* Set from 10 to 15 eggs under a goose, depending upon her size and the size of the eggs. It is usually wise to let the goose use her regular nest for incubating her eggs, because most geese are not inclined to sit in a new place. Goose eggs hatched under hens or geese should be *sprinkled with lukewarm water* every day after the fifteenth day.

When incubating goose eggs in an incubator, the temperature to be maintained depends upon the type of incubator. In section-type incubators, maintain a temperature between 101.5 and 102.5°F. at the top of the eggs as they rest on the tray. In a forced-draft incubator, maintain a temperature of 99°F.

Goose eggs need more moisture than chicken eggs during the incubation period. In section-type incubators, after the fifteenth day sprinkle the eggs daily with lukewarm water or soak them for about 1 min. in water at a temperature of about 100°F. every second day and every day during the last week. Tray eggs horizontally.

Whether goose eggs are incubated under hens or geese or in incubators, test the eggs about the seventh day and remove all infertile ones and those containing dead embryos.

4. Rearing Goslings

If given proper care and attention, goslings are relatively easy to rear. Goslings hatched under hens should be examined for lice at hatching time, and, if lice are present, rub a little lard, grease, or vaseline over the head and neck. A hen or a goose with her goslings should be given dry quarters, especially at night. Confine the hen or goose to a coop with a board floor for about the first 10 days and give the goslings access to a small yard of short grass or other succulent pasture. Be sure the goslings are confined to the coop until

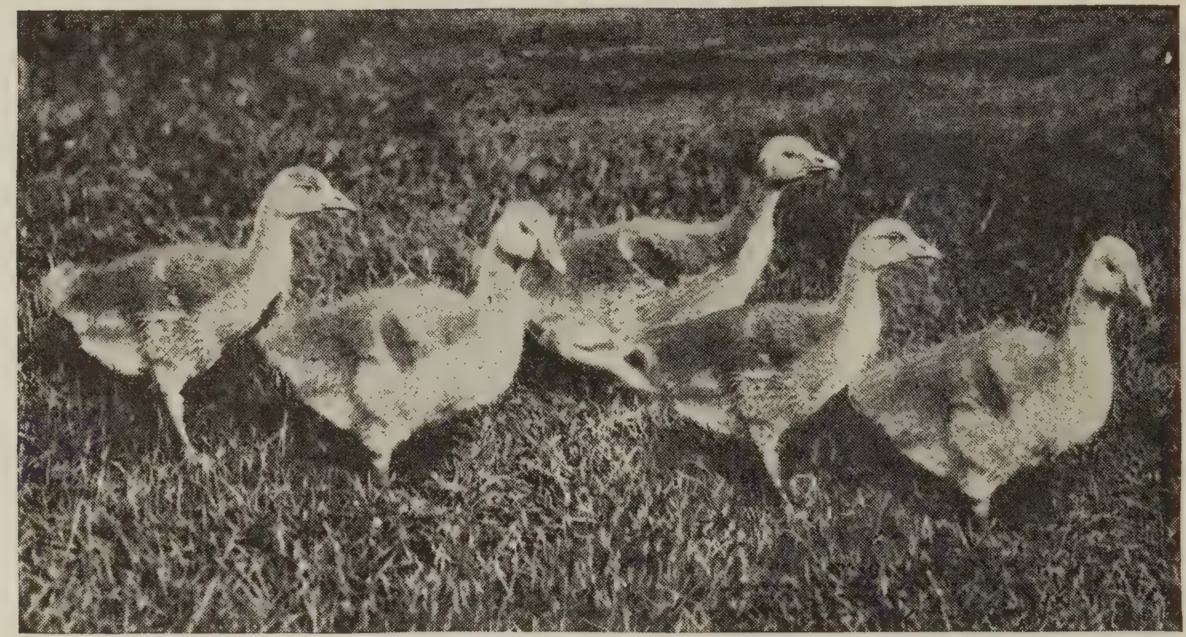


FIG. 204.—Toulouse goslings about 5 weeks old. (*U.S. Department of Agriculture.*)

the dew is off the grass and keep them out of water until they are about 3 weeks old. Provide every protection against natural enemies. Move the coop frequently to keep the premises clean.

Goslings hatched in incubators may be brooded artificially, maintaining the same brooder conditions as described for ducklings in the preceding chapter. In hot wheather, provide shade for goslings to avoid death from sunstroke.

5. Feeding Geese

Geese that are selected as breeders should never be fattened as the market birds are fattened in the fall of the year. Keep the breeding stock separate from the market stock.

Feeding Breeders. During the fall and early winter, succulent pasture alone is sufficient to keep the breeders in good condition.

Should the pasture dry up, provide them with an abundant supply of cut greens, fruits, and vegetables, such as rape, cabbage, clover, alfalfa, Swiss chard, beets, turnips, apples, and tomatoes. A few oats could be fed occasionally. Do not overfeed breeders, because they are inclined to become fat anyway. Give them plenty of exercise.

If eggs are wanted by March, begin feeding the breeders a little mash in addition to the green-feed and vegetable diet about the first of January. A mixture of 70 parts bran or shorts, 25 parts yellow cornmeal, and 5 parts fish meal or meat scrap makes a satisfactory breeding mash. Mix this mash thoroughly with cut clover, cut alfalfa, or other green feed and moisten the whole mixture with water until it is in a crumbly condition; do not make it too wet. Feed this mixture in the morning and again in the afternoon, as much as they will readily clean up, but do not overfeed. In the evening a light feeding of oats or a mixture of oats, corn, wheat, and barley or any combination of any of these cereals can be fed, but do not use too much corn. Keep grit and oystershell available at all times. A constant supply of clean water is very important. Overfeeding the breeders and lack of exercise will make them too fat and reduce the fertility of the eggs produced. Access to a pond or other body of water tends to increase fertility and encourages the breeders to take plenty of exercise. Pellets may be fed instead of mash.

Feeding Goslings. Throughout the growing period, the major portion of the goslings' "bill of fare" should be tender grass or other succulent green feed. About 24 hr. after hatching, feed stale bread-crumbs soaked in milk or water or a chick starting mash moistened with milk or water until it is in a crumbly condition, and have clean drinking water readily available. To the moistened mash mixture add finely chopped grass, lettuce, or cabbage. Pellets may be fed instead of mash. Feed the goslings three times daily what they will clean up in about 15 min. each time.

After about 3 weeks, if plenty of succulent pasture is available, no other feed is necessary until fattening time. If suitable pasture is not available, however, extra feeding is advisable and should consist largely of cut green feed and vegetables plus a light feeding twice daily of chicken growing mash or a mixture of two parts shorts and one part cornmeal. The importance of providing succulent pasturage for goslings cannot be overemphasized. It reduces the cost of feeding and promotes rapid growth. Cow or sheep pasture land is satisfactory, but low-lying, somewhat marshy land is ideal. If permanent pasture cannot be maintained throughout the summer, sow rape, rye, or oats for summer and fall pasturing.

Fattening Geese. Most of the market geese raised in the United States are sold for the Thanksgiving and Christmas markets. Some commercial goose raisers, however, make a business of selling their geese at 10 to 12 weeks of age, usually under 12 weeks, because at that time the pinfeathers of the adult plumage start to grow. At this size these market geese are called "green geese," a term analagous to green ducks, described in the previous chapter.

For fattening geese at any age, partly darkened fattening pens, where the geese are kept as quiet as possible and have little room for

FIG. 205.—Toulouse goslings about 12 weeks old on farm of A. E. Ehrhart, Illinois. (*J. C. Allen and Son.*)

exercise, are recommended. Feed twice daily a good fattening mash made up of one part shorts and two parts yellow cornmeal moistened with water to a crumbly condition and in addition a light feeding of three parts whole corn and one part oats or barley. Provide plenty of clean drinking water. Feed vegetables or other roughage. Rapid gains are made, and about 1 month's feeding is sufficient to put the geese in prime market condition.

Noodling. A more complicated method of fattening, involving much more labor but producing a superior finish, is the process of noodling geese, or force feeding with specially prepared noodles. The geese are confined to pens of limited size to prevent them from exercising and are stuffed with noodles several times daily for about 1 month.

The noodles are made of equal parts of scalded yellow cornmeal, ground oats, ground barley, and ground wheat or various combinations of these and other ingredients, and a small amount of salt. The ground grains are mixed thoroughly, run through a sausage stuffer and cut into noodles about 3 in. long, and cooked for about 15 minutes. The cooked noodles are then dipped in cold water and rolled in flour to prevent them from sticking together. Before the noodles are to be fed, hot water is poured over them to make them slippery.

At feeding time, the feeder sits on a box or chair in a corner of the fattening pen and holds each goose between his legs with its back

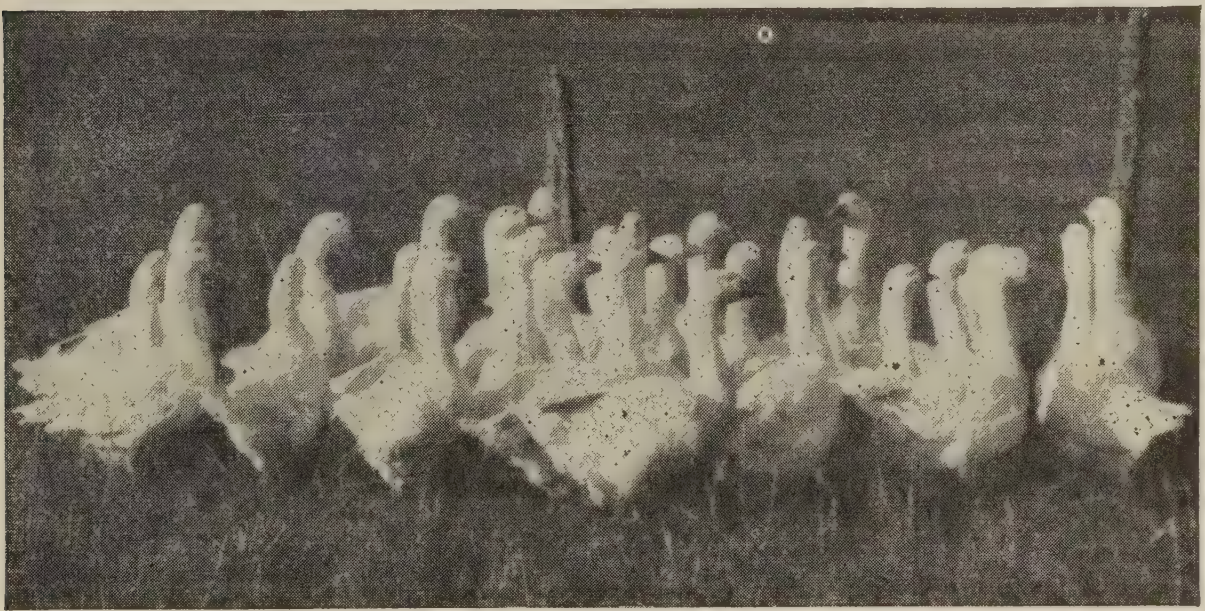


Fig. 206.—A flock of Embdens at marketing time on a Maryland farm. (*University of Maryland.*)

toward him. He places the noodles, one at a time, in the goose's mouth and forces them down the throat by exerting pressure on the goose's neck from the outside. At the beginning of the fattening period, usually from three to five noodles are fed three times daily. As the fattening period advances, up to seven noodles are fed five times daily, usually beginning about 5 A.M. and the last feeding about 11 P.M. A goose should not be fed if there is any feed in the crop at feeding time. Keeping fresh drinking water before the geese at all times is highly important. Gains of from 6 to 10 lb. per bird are possible during a fattening period of a month or a little longer.

One outstanding effect of noodling geese is an enormous enlargement of the liver, sometimes attaining a weight of 2.5 to 3 lb. in large geese. In various countries of Europe, for many years, enlarged goose livers have been used for making a delicacy called *pâté de foie gras*, which means "paste of fat liver." Fried goose liver is highly prized in several European countries.

Comparing Rates of Growth. Goslings secured from purebred Embden and Toulouse matings weigh approximately 3 to 3.5 oz. at hatching time. During the first 3 or 4 weeks the gain in weight made by all goslings is very rapid. Thereafter, the rate of gain is slower until about the twentieth week, when fattening gives rise to large gains in weight.

Since geese are excellent foragers and obtain most of their feed from pasture, if it is kept in a succulent condition, it is very difficult to obtain data concerning the number of pounds of feed consumed per pound of gain in body weight. However, where good pastures are available, it is obvious that geese are very efficient converters of feed into food particularly from the standpoint of the cost of feed.

Purebred Embden and Toulouse goslings secured from good breeding stock and raised under optimum conditions have been known to weigh 4.5 lb. at 1 month and from 10 to 12.5 lb. at 10 weeks of age. Most farm-raised goslings, especially those secured from mongrel breeding stock of average size, could not be expected to make such remarkable gains in weight. The weights per bird in pounds given below are approximate weights that should be possible to obtain with farm-raised goslings secured from good breeding stock and given proper care and feeding, including fattening diets during the last month.

Age in weeks	4	8	12	16	20	24	28
Embden and Toulouse goslings	3.5	7	9.5	11	12	13	16
Other goslings	2.0	5.5	7.5	8.5	9.5	10.5	13

The figures given here indicate that the production of green geese, sold at about 11 or 12 weeks of age after being fattened, would be more profitable than raising geese up to the normal marketing time. The figures also show that raising goslings of the larger breeds is more economical than raising those of the smaller breeds or of ordinary mongrel breeding. Noodled geese of Embden and Toulouse breeding sometimes attain weights of 25 to 30 lb.

6. Marketing Geese, Feathers, and Eggs

Geese that are not marketed as green geese at about 10 to 12 weeks of age should be kept and fattened for the Thanksgiving or

Christmas market, depending upon the time they were hatched and the prevailing price.

Geese are sold alive, dressed, and eviscerated. Many farmers who raise considerable numbers each year make a practice of selling their geese alive to others who make a special business of fattening geese for market. The practice of marketing eviscerated birds is increasing, particularly by those who specialize in producing high-quality market geese and by poultry dressing-plant operators.

FIG. 207.—A goose-fattening farm where thousands of geese are fattened every year. (*U.S. Department of Agriculture.*)

Killing and Plucking Geese. At killing time, handle market geese as carefully as possible so that the skin will not be torn or the flesh bruised. With a long-bladed knife, sever the jugular vein in the throat just below the base of the skull by inserting the knife through the mouth. Then plunge the knife through the roof of the mouth and pierce the brain, or hit the back of the head a sharp blow to stun the bird.

Dryplucking geese is a very difficult job, especially when the geese have been well fattened. In most cases the birds are scalded slightly or the feathers are steamed. For scalding, hold the bird by the head and feet and dip quickly into scalding water and wrap the bird in burlap or cloth with the head under the breast. After about 5 min. unwrap the bird and begin plucking the feathers at once, being sure not to leave the breast turned down too long, or the flesh may be scalded. To steam the feathers, stretch a piece of burlap over the top of the boiler containing the scalding water and lay the goose on the burlap. Steam the breast, then the back, and then each side, being careful not to steam the breast too long. Two or three minutes is usually sufficient for the whole steaming process, but you can tell best how long to steam by plucking at some of the feathers to determine how soon the birds can be removed. Semiscalding and wax plucking are employed in plucking geese in large dressing plants. Singe each dressed bird by holding it over an alcohol flame.

The evisceration of geese is carried out in the same manner as that of dressed chickens, described in "Successful Poultry Management," and as for dressed turkeys described in Chap. 7 of this book.

Grading Dressed Geese. In grading geese for market, no distinction is made between old and young geese. United States Grade A geese are full-fleshed, fat birds of any age and of either sex, free from blood spots, bruises, dressing defects, and deformities. United States Grade B birds are well-fleshed, well-dressed birds of any age and of either sex, free from deformities, or they may be full-fleshed birds that show slight deformities or slight dressing defects. United States Grade C birds are edible birds of any age and of either sex inferior to U.S. Grade B. The weight specifications for Grade A and B dressed geese are as follows:

Weight range per bird		Weight range per dozen	
Minimum	Maximum	Minimum	Maximum
None	7 lb. 15 oz.	None	95 lb. 15 oz.
8 lb.	9 lb. 15 oz.	96 lb.	120 lb. 15 oz.
10 lb.	None	121 lb.	None

All dressed geese of the quality of U.S. Grade C may be packed together regardless of their weight.

Packing Geese. Pack dressed geese in barrels or boxes in a manner similar to dressed ducks. Eviscerated geese are usually box-packed and quick-frozen the same as eviscerated ducks.

Goose meat is largely consumed in the form of roast goose. The marketing of *pâté de foie gras* or "paste of fat liver" has already been mentioned. Smoked goose breast is a delicacy that is sometimes marketed.

Marketing Goose Feathers. In olden times when goose feathers were in such great demand for bedding and for other purposes, it was common custom to pluck live geese two or three times a year. Plucking live geese was a prevailing practice in European countries for many years but never made much headway in the United States.

It is quite certain that the geese do not enjoy being plucked. Do not pluck them after the middle of November or they will not feather out by marketing time. Do not pluck geese during the breeding season. Farmers' wives desirous of securing a supplementary supply of feathers for filling pillows and mattresses could pluck their geese during the late summer or early fall and then only when the quills appear dry and contain no blood. Put a stocking over the goose's head and pluck the soft feathers from the back, breast, sides, and abdomen. An average-sized goose will yield about 1 lb. of feathers.

Practically all goose feathers that are marketed in the United States are secured from geese that are killed and dressed for market. White feathers are preferred to colored ones. When geese are dry plucked, put the feathers directly in coarse burlap sacks, to prevent them from becoming soiled, and hang the sacks in a dry room to permit of thorough drying. Wet feathers from scalded geese must be washed thoroughly to remove all dirt and blood stains and then dried.

Prices for feathers vary according to the demand, which over a period of years has decreased steadily because new materials continue to appear on the market for making mattresses and other things for which feathers were originally used. During the Second World War the demand for feathers was greatly intensified because normal importations from various countries were excluded.

Marketing Goose Eggs. There is but a limited demand for goose eggs for human consumption. Prices are highest just before the Easter holiday season but drop decidedly immediately after Easter. From 1931 to 1935 the average price in New York City 2 weeks before Easter was $1.80 per dozen and from 1937 to 1941 the average price was $2.29 per dozen.

7. Controlling Goose Diseases

Losses from mortality among geese are usually not so great relatively as among chickens and turkeys, probably because geese are raised in smaller units and forage widely so much of the time. Various diseases attack geese, however, and some of them are often fatal. Botulism, avian staphylococcosis, and paratyphoid are three diseases common to ducks and geese as well as other poultry. For a discussion of symptoms and treatment of these diseases, see Chap. 6.

Goose influenza is a disease that has caused severe losses among flocks in Europe but has not become prevalent in the United States. Both goslings and adult geese are susceptible to this disease, which generally appears in May or the fore part of June, reappears the latter part of August or September, and disappears from a flock in about 2 to 4 weeks. Mortality is sometimes very high. The cause is a specific bacterium. Infected birds lose their appetites, have ruffled feathers, stagger while walking, and breathe heavily. The course of the disease in individual birds is usually 2 to 5 days. Upon examination of dead birds, the lungs have lesions, the air sacs are inflamed, and a film covers the surface of the liver. No treatment is known. The most effective preventive measures are to keep the premises used by geese clean and provide clean feed and water.

The best way to prevent losses from all diseases affecting geese is to keep the breeding quarters clean and dry and the brood coop or brooding pen sanitary at all times. Always feed clean feed and provide clean water and always keep the feeding and watering utensils clean.

SUMMARY

1. The Toulouse, Embden, and African breeds are the fastest growing breeds and, therefore, utilize feed more efficiently in producing meat than other breeds.
2. One gander may be mated with up to five females.
3. The best age for breeding is from the third to the fifth year.
4. About 2 months before eggs are wanted, start feeding the breeders mash.
5. For artificial incubation in section-type incubators, maintain a temperature between 101.5 and 102.5°F., at the top of the eggs; in forced-draft incubators, maintain a temperature of 99°F.
6. Goose eggs require plenty of humidity; after the fifteenth day sprinkle them with lukewarm water every second day.
7. Brooding conditions for goslings are practically the same as for ducklings.
8. Feed a mash for about 3 weeks, after which no other feed is necessary until fattening time, providing succulent pasture is always available.
9. In fattening geese for market, feed mash twice daily in addition to a grain mixture and vegetables.
10. Exercise the greatest possible care in dressing geese and save the feathers, which should be properly dried.

11. Raising Guineas, Pigeons, and Peafowl

FOR food production, guineas and certain breeds of pigeons are of considerable importance, and for ornament and pleasure other breeds of pigeons and peafowl are quite popular. Raising these three kinds of fowl is presented under the following headings:

1. Raising Guineas
    - Selecting Breeders and Mating Them
    - Incubating Guinea Eggs
    - Brooding and Rearing Guineas
    - Feeding Breeders and Young Stock
    - Marketing Guineas
2. Raising Pigeons
    - Choosing Breeds for Squab Production
    - Choosing Breeds for Pleasure
    - Selecting Breeders and Mating Them
    - Hatching and Rearing Squabs
    - Feeding Pigeons
    - Housing Pigeons
    - Marketing Squabs
3. Raising Peafowl

1. Raising Guineas

Guineas are raised in all parts of the country, mostly in small flocks on farms, although there are persons who specialize in raising a few hundred each year. In some hotels and restaurants, roast guinea is served as a substitute for quail, grouse, pheasant, and partridge. As a result, the demand for guineas during recent years has been on the increase in some sections. The flesh is quite dark and in young birds is tender and has a fine flavor.

Some farmers keep a few guineas as guardians of the poultry yard because they usually utter harsh cries at the least disturbance, especially if crows, hawks, and other natural enemies appear near the premises. One possible objection to raising guineas on the farm is that they are apt to fly all over the premises and thus may spread disease among chickens and turkeys. On the other hand, if kept under reasonable control, raising guineas not only provides excellent food for the home table but is a source of income where the market demand is good.

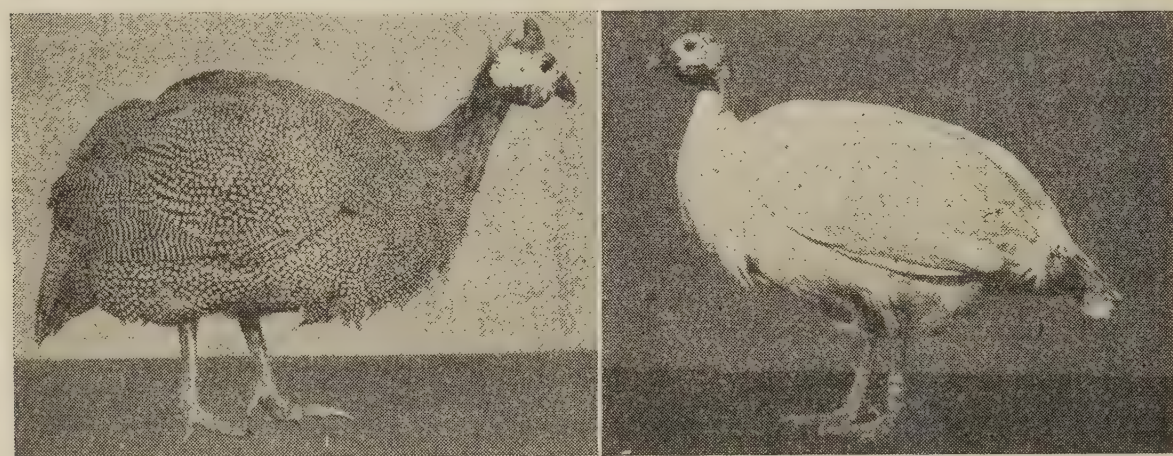


FIG. 208.—Left, Pearl guinea. Right, White guinea. (*U.S. Department of Agriculture.*)

Selecting Breeders and Mating Them. There are three domestic varieties of guineas, the Pearl, White, and Lavender, all descended from a wild North African species. The most popular variety in this country is the Pearl, which has purplish-gray plumage, regularly dotted or "pearled" with white. The White variety has

FIG. 209.—The male guinea on the left has a larger helmet and wattles than the female on the right. (*U.S. Department of Agriculture.*)

pure-white plumage. The Lavender variety has light-gray or lavender plumage, regularly dotted with white.

Distinguishing the Sex. The sexes resemble each other to a marked degree and care must be exercised in selecting breeding stock to avoid keeping all of one sex. The male has a larger helmet and wattles than the female, as shown in Fig. 209. Another aid in distinguishing the sex is to listen to the cry any time after the birds are 2 months old. That of the male is a one-syllable shriek while that of the female resembles a cry of "buckwheat, buckwheat."

Mating Breeding Stock. Mate one male to four or five females and give them access to range. Select birds for breeding purposes with well-developed bodies and well-fleshed breasts. The females usually commence laying in April or May and lay upward of 30 eggs before becoming broody. If broken up immediately, they will lay again. Each hen may make her own nest in a fence corner or among weeds, or all of the hens mated to a male may lay in the same nest. Sometimes the nests are difficult to find, but the male may unconsciously help you to locate the nest because he usually utters a piercing shriek as you approach the hen on the nest.

If you plan to hatch guinea eggs under chickens or in incubators, do not remove all the eggs from the guinea nest when you collect them or the guinea is liable to desert that nest and build a new one. Always leave four or five eggs in the nest. If there is danger of natural enemies finding the nest and destroying the eggs, it would be well to clip the flight feathers of one wing at the commencement of the breeding season and keep the guineas under reasonable control. Make a special place for nests because it is the guinea's instinct to hide her nest. Gather the eggs regularly and store them in a cool place, but do not hold them over about 10 days.

Incubating Guinea Eggs. The incubation period of guinea eggs is 28 days, although hatching may commence as early as the twenty-sixth day and be over by the twenty-seventh day. Chicken hens (including bantams), guinea hens, and incubators may be used for incubation.

Chicken hens are more suitable for incubating guinea eggs than guinea hens, because the latter are more nervous and are inclined to leave the nest with the first guinea chicks hatched, thus ruining the rest of the eggs. Moreover, if guinea hens are used, they must be allowed to use the nests in which they laid. Thus, the guinea chicks are in some danger of being attacked by natural enemies shortly after being hatched. A chicken hen of one of the general-purpose breeds will accommodate up to 24 guinea eggs and a bantam hen up to about 12 eggs. Avoid lice by treating the setting hen with several pinches of sodium fluoride rubbed over different parts of the body, especially around the vent. Should lice appear on the guinea chicks, treat the mother hen with sodium fluoride again and rub grease or lard over the heads and around the wing joints and vents of the guinea chicks.

Incubators used for hatching guinea eggs should be operated in the same manner as for chicken eggs, discussed fully in "Successful Poultry Management." If you decide to use an incubator, write to the manufacturer for instructions concerning operation.

Brooding and Rearing Guineas. Guinea chicks can be brooded with greater success with chicken hens than with guinea hens, because it is difficult to confine the latter to coops for the first few days of brooding.

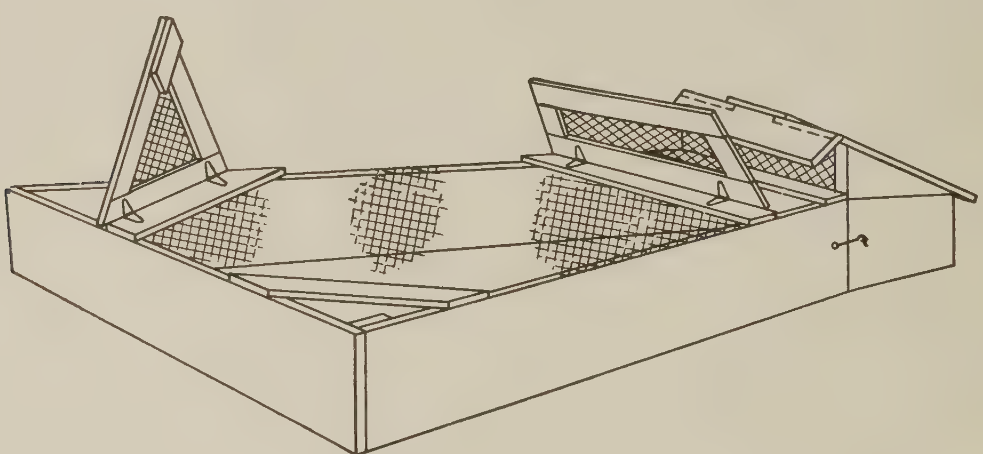


Fig. 210.—Brood coop with board floor for mother hen and guinea chicks, with enclosure to confine the chicks for about 1 week. The wire netting door in front of the coop makes it easy to feed the hen. The triangular netting door at the corner is for feeding and watering the chicks.

Provide a fair-sized, rainproof coop without a floor for the chicken hen and her foster brood, with an enclosure in which the guinea chicks are confined for the first few days. Place the coop in a yard or field, where the grass is short, some distance from the farm buildings, because young guineas must have range to do well. For the first few days be sure that the guinea chicks are not allowed to roam in the wet grass. After about 1 week remove the enclosure attached to the coop and give the hen access to the yard or field. By this time the mother hen and her brood are accustomed to their home and will return to the coop for shelter at night.

When the young guineas are about 6 or 8 weeks old they are likely to leave the coop at night and roost in near-by trees or other convenient places. They prefer roosting in the open but can be taught to roost in a house or shed if driven into the place for a few nights just about the time they begin roosting. If they are taught to roost in a house or shed, they are much more easily caught at marketing time than if allowed to roost in trees; in fact, guineas that have formed the habit of roosting in trees are very difficult to catch when wanted. In handling guineas, carry them by their wings.

Brooding guinea chicks artificially has not been practiced extensively. Since guinea chicks are naturally wild, they must be given more careful attention than baby chicks and turkey poults, especially with respect to sanitation. Otherwise, brooding methods are the same as for baby chicks and poults.

To prevent young guineas from flying, snip off the last joint of each wing when they are 1 or 2 weeks old (see Fig. 227).

Feeding Breeders and Young Stock. Guineas, both old and young, are great foragers and normally seek a good part of their living from the fields.

Breeding stock must be given supplementary feeding during the late fall and winter. Feed a mixture of corn, wheat, and oats twice daily. Fish meal or meat scrap and skim milk adds protein to the diet and induces better egg production. Provide green feed regularly as well as vegetables, such as beets, cabbages, turnips, and potatoes. Grit and oystershell should be accessible in self-feeding hoppers.

Feed guinea chicks much the same as baby chicks, except that since guineas are such natural foragers they require less supplementary feeding than baby chicks. Hard-boiled eggs mixed with breadcrumbs or breadcrumbs soaked in milk are good for the first few feedings. A chickstarting mash is satisfactory for the first 2 or 3 weeks, after which it should be changed to a chickgrowing mash. If succulent green feed is not available on range, feed cut grass, lettuce, or other green feed regularly. Keep clean drinking water, grit, and fine oystershell available at all times. After the young guineas are about 6 weeks old, feed cracked corn and whole wheat. During the summer the growing birds will get most of their living from the fields. To fatten them for market in the late summer and fall, a mixture of corn and wheat is satisfactory, plus vegetables.

Marketing Guineas. In most cases, the earlier you can get your birds to market, the higher the price you receive and the more profit you make. At 4 months your young guineas should weigh 2 lb. each or more. They are killed and dressed in the same manner as chickens, dry plucking being preferable. They are often called "keets".

2. Raising Pigeons

Pigeons are raised in all parts of the United States for three different purposes, squab production for profit, racing pigeons for carrying messages, and ornamental varieties for pleasure. The discussion in this chapter is concerned primarily with raising pigeons for profit, because this book is devoted primarily to problems of food production by different kinds of poultry.

The first pigeons marketed for human consumption in the United States were the Passenger or "wild" pigeons of colonial days. Fully 200 years ago there were millions of them, a single flock during migration time sometimes being 1 mile wide and 4 miles long. Nesting colonies, each covering several thousand acres, were quite common. Imagine three carloads, each containing 150 barrels of pigeons, shipped per day for 40 days from one town. Between March 22 and August 12, 1878, 1,500,000 birds were shipped from Petoskey, Mich. In 1879 it was estimated that there were 5,000 men engaged regularly in wild-pigeon hunting. So great was the destruction, especially during the breeding season, that the wild stocks were rapidly decimated. The species became extinct when the last bird died in captivity in 1914.

Choosing Breeds for Squab Production. For successful squab production, good body size, ability to produce several hatchings of squabs each year, and rapid growth in the squabs are all very important factors. The more important breeds kept for squab production in the United States include King, of which there are the White and the Silver varieties; Runt, of which there are the White and the Blue varieties; Carneau, of which there are the Red and the White varieties; Giant Homer; French Mondain; and Swiss Mondaine.

In order to give some idea of the relative size of these different breeds, the standard weights in ounces are given here, except for the Runt, for which there appear to be no standard weights.

Breed	Old cock	Old hen	Young cock	Young hen
King	30	26	28	24
Carneau	25	23	23	22
Giant Homer	27	25	24	22
French Mondain	29	27	28	26
Swiss Mondaine	30	28	28	26

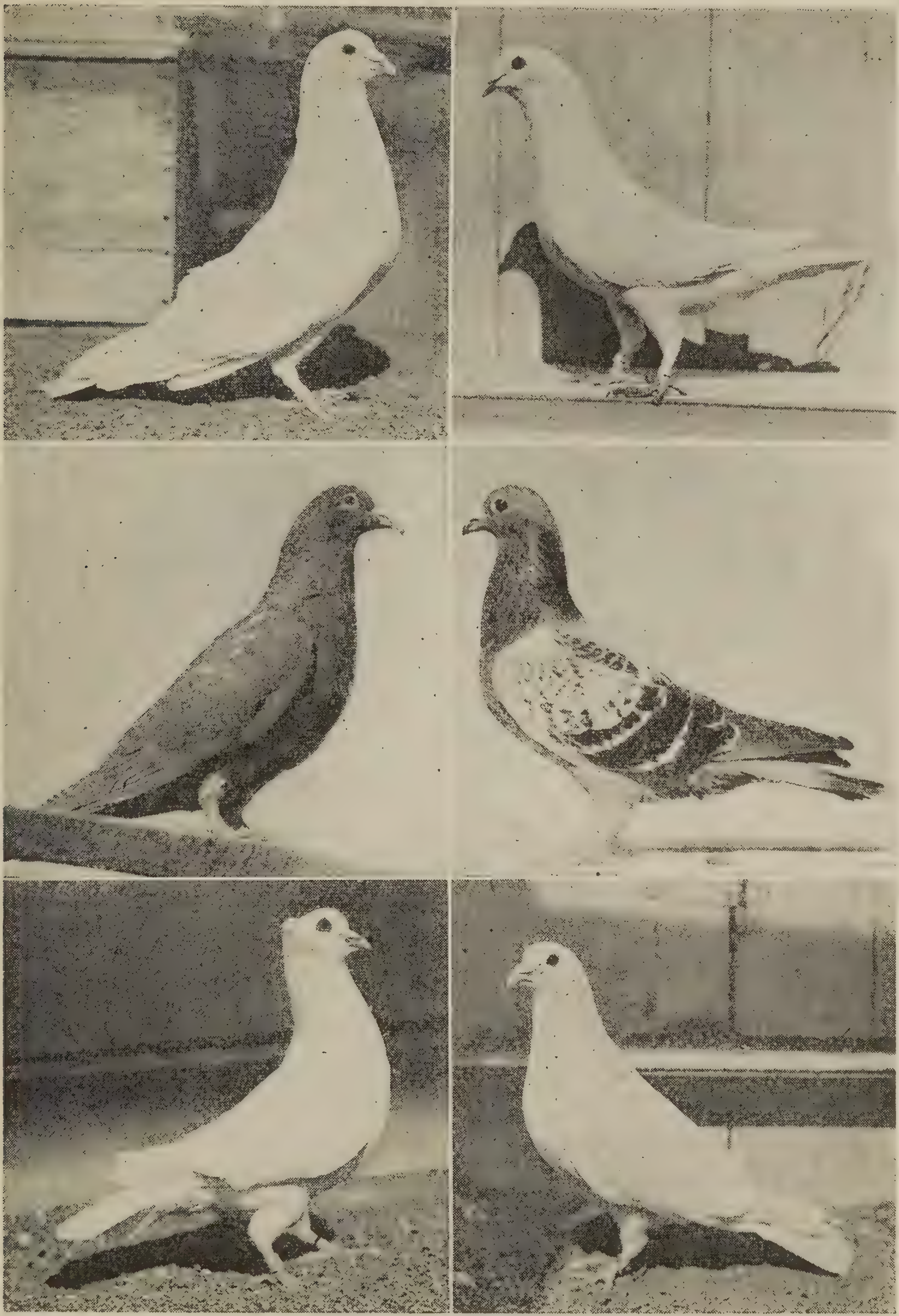


FIG. 211.—Popular breeds of pigeons for squab production. Top left, White Runt male. Top right, White King male. Center left, Red Carneau male. Center right, Giant Homer male. Bottom left, French Mondain male. Bottom right Swiss Mondaine male. (*U.S. Department of Agriculture.*)

King. Although there are five varieties of the King pigeon, including the Red, Blue, White, Silver, and Yellow, only the White and the Silver varieties are used extensively for squab production. The White King is more popular as a commercial squab producer than the Silver King. The King is a tight-feathered breed, with a short, deep, blocky body and broad breast. Well-bred flocks of Kings produce from 14 to 16 squabs per pair a year. The squabs grow rapidly and at marketing time will average from 16 to 24 oz., each, live weight.

Runt. The Runt is the largest of all breeds of pigeons and is, therefore, poorly named. It produces heavier squabs than other breeds but usually not so many of them in a year. The body is very broad and deep, the full breast being carried slightly elevated from the horizontal.

Carneau. The Red Carneau has been bred more extensively for squab production than the White Carneau. In both varieties the body is short and compact, with an upright carriage and a full breast. The plumage of the Red variety is a deep chestnut red throughout.

Giant Homer. This breed is popular among commercial squab producers who have a demand for squabs of somewhat smaller size than produced by some other varieties. The Giant Homer is usually a good breeder and feeds its young well. It has a slightly longer and less compact body than the King but has a broad, deep breast.

French Mondain. This relatively new squab-producing breed has gained in popularity during recent years. It has a short body, with a very deep and broad breast. The White variety is the most popular of several varieties.

Swiss Mondaine. In spite of its name, this breed was developed in the United States. The Swiss Mondaine resembles the White King, except that it is slightly longer and more slender and the body is not carried quite so erect. It is a good producer of large squabs.

Choosing Breeds for Pleasure. Pigeon raisers who are not interested in squab production usually keep pigeons for flying or for ornament.

The Flying Homer is the most popular breed for training for flying. It has been used extensively for carrying messages both in peace and in war, in the latter having performed remarkable services. In developing birds for flying, careful training is probably as important as good breeding. Pigeon races are held regularly in all parts of the country. Young birds will fly upward of 300 miles in about

8 hr. in good weather, and old birds will fly upwards of 600 miles in a day, although 500 miles is a good flight.

There are many fancy breeds kept as a hobby, either because of their beautiful plumage or because of some outstanding characteristic, such as the spreading of the tail in the Fantail breed or tumbling antics of the Tumbler. Some of the breeds kept for ornament include Nuns, Carriers, Maltese, Pouters, Tumblers, and White Fantails.

Selecting Breeders and Mating Them. One of the most important causes of failure in many squab-producing enterprises has been inferior foundation stock. Good-quality breeding stock is absolutely essential to secure best results. If you intend to raise pigeons for squab production, be sure to buy breeding stock from a reliable breeder who carries on a sound breeding program and knows the relative merits of his different matings. A good breeder keeps accurate records of his matings, the number and quality of squabs they produce, and the cost of producing the squabs as well as the cost of keeping the breeders. You may purchase young pigeons that are about ready to be mated or mated pairs. Young pigeons are ready to mate when they are from 6 to 8 months old, but they should be of good size and well matured. It would be well to follow the advice of the breeder from whom you purchase them as to how to mate them. Well-bred pigeons usually give good results in squab production for about 5 years.

Mating the Breeders. Pigeons mate in pairs and each pair usually remains faithful to each other during the succeeding reproductive cycles of the season. Never allow unmated birds, especially males, in the pen with mated pairs, because the unmated birds are inclined to fight with the mated ones and break up their nests.

The sex of pigeons is difficult to determine. There are several factors, however, which are of assistance and will increase proficiency in distinguishing males from females. The head of the female is more refined than that of the male, and as adults the female is usually a trifle smaller than the male. The male struts and coos more frequently than the female and often drags his tail on the ground. At mating time, the male is more aggressive than the female and is very persistent in "driving" her about the pen, after turning completely around in courtship, while the female usually turns about halfway around. The female has a tendency to waddle while walking and holds her tail higher than the male. Watching a pair in the act of mating is not a guaranteed method of distinguishing the sex, because two males or two females will sometimes perform the act. After a female starts laying, the pubic bones are spread further apart than in the male. During the incubation period, the male usually sits on the nest from about noon to evening while the female sits on the nest the rest of the time. The male roosts away from the nest at night.

Since it is practically impossible to distinguish the sex of squabs up to the time they are ready for market or are ready to leave the nest, squabs that are to be kept as breeders are banded, at about 7 to 10 days

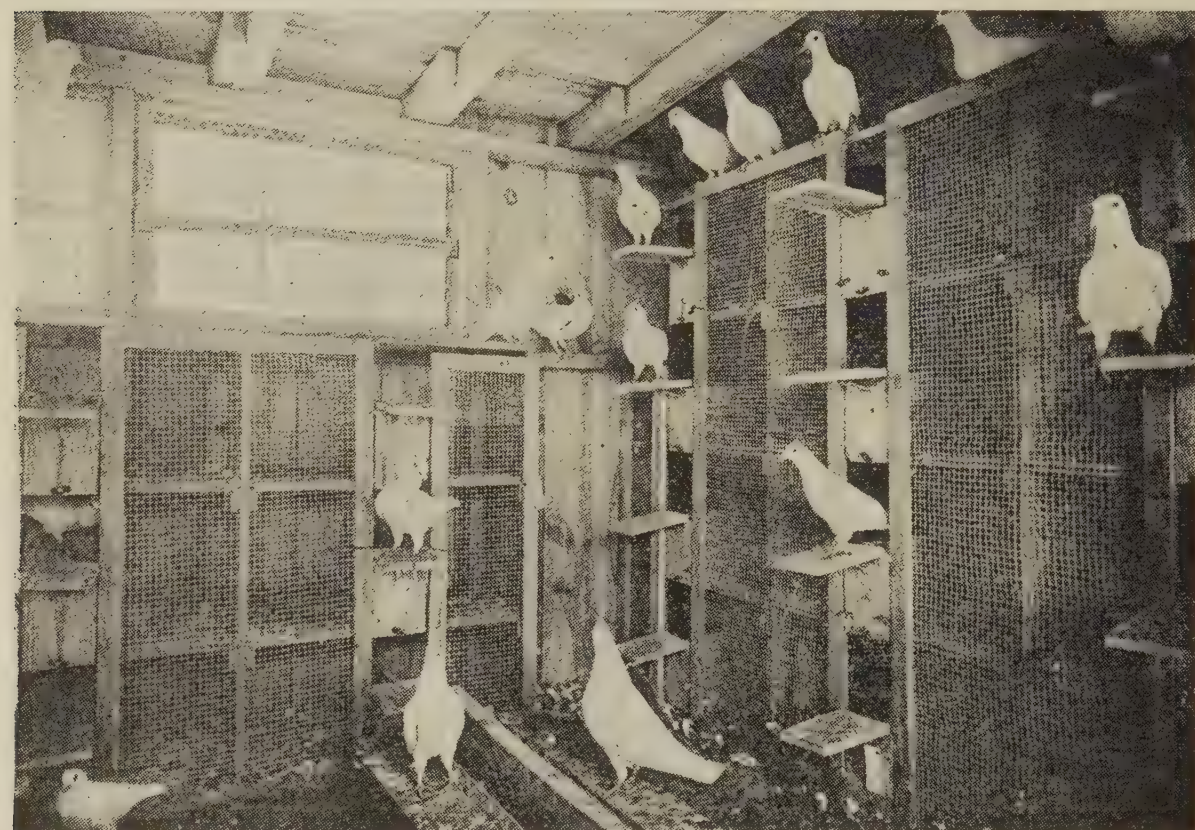


Fig. 212.—Double nest boxes with wire fronts. These nests may also be used as mating compartments. (*A. R. Lee and S. K. Haynes, U.S. Department of Agriculture.*)

of age, with a nest-band number, a seamless aluminum band usually being used. If you keep accurate records, the nest-band number of each squab will tell you from which particular pair of breeders it was secured and which squabs are full brothers and sisters.

You can follow one of two methods in mating your breeders, the natural method or the forced method. Under the natural method, the unmated birds in the pen are permitted to select their own mates. If the nest-band numbers on the birds show that two closely related birds have paired, it would be well to break up the mating. Under the forced method of mating, go over the birds and records carefully and decide which male you want to mate to a certain female and then put them together in a separate compartment, keeping them there for about 10 days. When well mated, each bird is given a numbered celluloid leg band and the pair is placed in the breeding pen.

Selecting Future Breeders. The problem of selecting future breeders from among the squabs produced each year is a very important one, because the quality of squabs saved for breeding determines to a large extent the quality of squabs you will secure from subsequent matings. The female usually lays two eggs at each nesting time, the

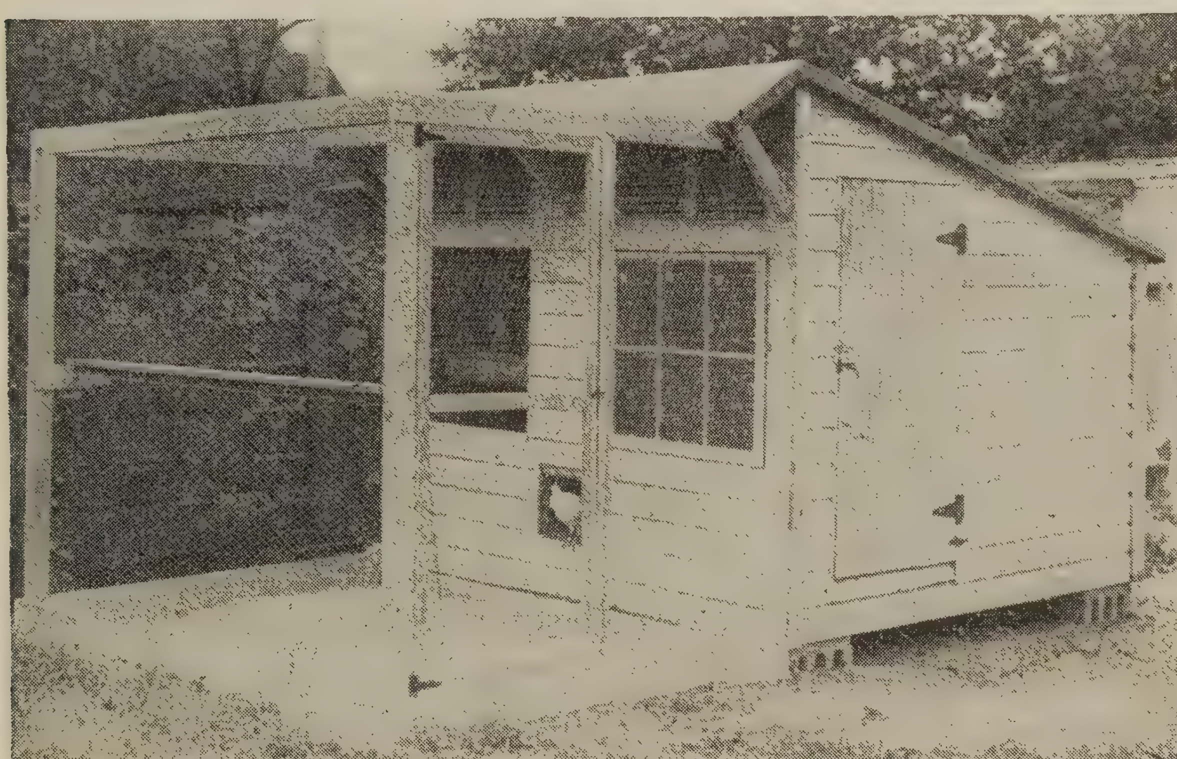


FIG. 213.—A back-yard pigeon loft. (*C. S. Platt, New Jersey Experiment Station.*)

second egg being laid the second day after the first one. A pair of good breeders should produce at least 12 squabs in a year. Go over your records carefully and select squabs for breeding purposes from the pairs of best breeders, culling out all poor breeders. Squabs produced by proved breeders of merit should be saved for future breeding rather than squabs from young pairs, at least until the breeding worth of the young pair has been established.

Commercial pigeon breeders for squab production usually place from about 25 to 40 pairs of breeders in a pen, the smaller number being preferable. Once a pen of mated birds is made up, the birds should be disturbed as little as possible. If a bird dies, remove its mate. Do not place a remated pair in the same pen with either of the pair's former mates. Attach a card to each nest in the breeding pen, giving the band number of each parent, the date that eggs are laid, the date that squabs are hatched, the nest-band number of the squabs, and their weight. Go over your records carefully to see which pairs of breeders have produced the greatest number of large-sized, fast-growing squabs. Select future breeding stock from among the squabs secured from proved breeders. Furthermore, among the progeny of each pair of proved breeders, save for breeding purposes the best squabs only, because the progeny of each pair of breeders will show some variability.

Hatching and Rearing Squabs. The incubation period of the pigeon egg is 17 to 19 days, the second egg laid usually hatching a day later than the first egg laid. A good producing female usually lays another setting of eggs when the squabs are about 2 or 3 weeks old, the feeding of the squabs being left largely to the male. For this reason, double nests are necessary for each pair of breeders, so that the second setting of eggs can be laid in the second nest and thereby secure better results in hatching.

Squabs are fed by both parents, who produce in their crops a thick creamy mixture called "pigeon milk," which they feed the youngsters by mouth. During the rearing period, do not frighten either the parents or the squabs. If a squab in each of two pairs dies, the two single squabs may be placed in the same nest, thus hastening the laying of another setting of eggs by the female without any squabs. If both parents of a pair of squabs become sick or die, the squabs may be hand fed, provided they are at least 1 week old. Feed small grains that have been soaked in water for about 8 hr. until the squabs are 3 weeks old, after which soaked larger grains may be fed. Feed the birds three times daily, dropping feed into the squab's mouth until the crop is full. Give the squabs water after each feeding.

Squabs produced by superior breeding stock under good management should be ready for market when about 4 weeks old. Leave the squabs that are saved for breeding purposes in the breeding pen until they are about 8 weeks old, by which time they have learned to eat and take care of themselves.

Feeding Pigeons. Because the cost of feed represents over one-half of the total costs of producing squabs and because the breeders require feed for maintenance, egg production, and feeding their squabs, take particular care in selecting feedstuffs for pigeons and in methods of feeding them.

Diets for pigeons are quite different from diets for chickens, turkeys, ducks, and geese. Pigeons do not like mash mixtures, eat very little green feed, and do not eat insects and worms. A mixture of good-quality whole grains is the standard diet for pigeons, and it should contain about 14 per cent protein and not over 5 per cent fiber. Since corn, kafir, milo, and wheat are relatively low in protein content, these cereals are supplemented with grains relatively high in protein, such as field peas, cowpeas, Brabham peas, whippoorwill cowpeas, vetch seed, and rapeseed.

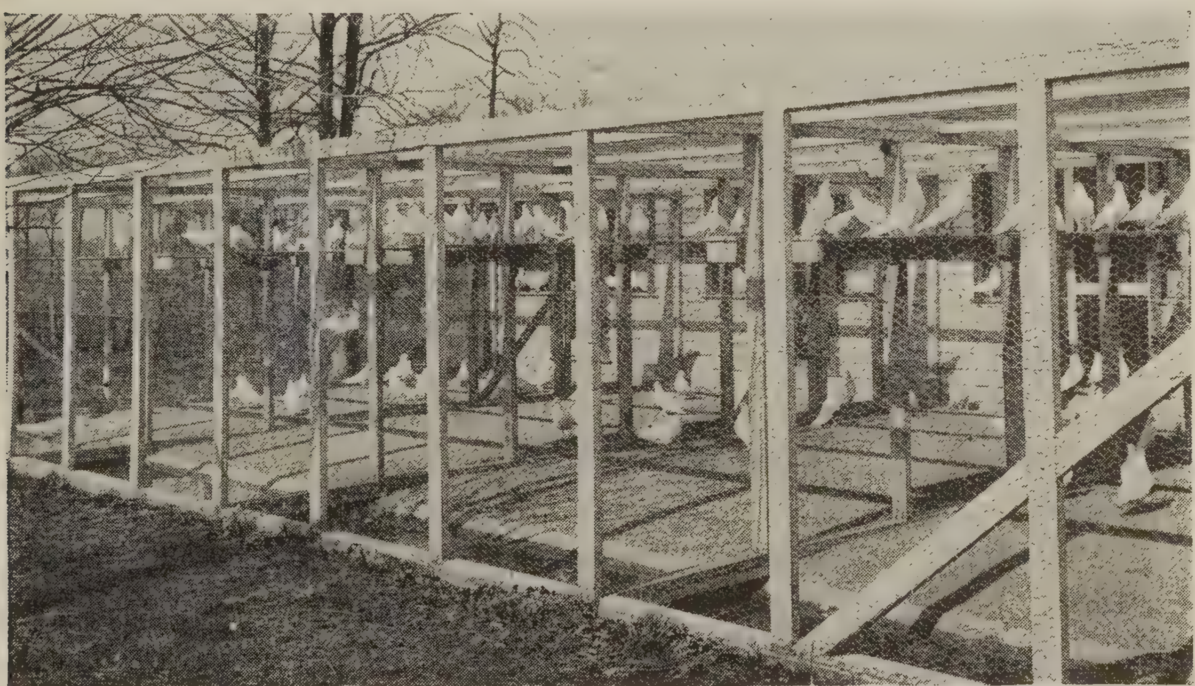


Fig. 214.—Wire-enclosed outside yard or "fly," covered with gravel. Fresh water is kept in the concrete trough at the front of the yard. (*A. R. Lee and S. K. Haynes, U.S. Department of Agriculture.*)

Use only good-quality whole hard grains, soft corn and soft wheat being lower in digestibility than hard corn and hard wheat and they are also much more apt to cause digestive disturbances in the breeders and in the squabs. Keep pigeon feed in a dry place, taking particular care to avoid weevil infestation.

Use yellow corn rather than white corn, the latter being deficient in vitamin A. Flint corn and small kernels of yellow dent are satisfactory. Kafir and milo make good pigeon feeds, although they are deficient in vitamin A. Hard red wheat is used to a considerable extent but should not comprise more than about 20 per cent of the grain mixture. Hulled oats are used to some extent because they are relatively low in fiber and relatively high in protein. Any of the different varieties of peas may be used, up to about 20 per cent of the diet.

Other grains and seeds may also be used, but adding some of these just to give variety is not necessarily good practice, because some of them are not so good as either yellow corn, wheat, or peas. Hempseed, for instance, is very palatable but is relatively low in protein and high in fiber and fat. Sunflower seed, although quite high in protein, is also high in fiber and very high in fat. Polished rice is relatively low in protein. Vetch seed is very high in protein and low in fiber and fat. If the price of these grains and seeds is favorable, any one of them could be used to the extent of about 5 per cent of the diet.

If you have a small flock, you would be wise to buy a commercially mixed pigeon feed prepared by a reliable feed company. Many commercial squab producers purchase the grains and seeds they need and prepare their own grain mixtures. For those who wish to mix their own pigeon feed, any one of the following formulas might be used.

Ingredient	Percentage			
Yellow corn	35	30	35	35
Hard red wheat	20	20	20	15
Kafir or milo	15	20	15	20
Peas	20	20	20	20
Vetch seed	...	3	3	3
Hempseed	5	2	3	2
Millet	...	...	2	3
Polished rice	...	5	2	
Hulled oats	5	...	...	2
Total	100	100	100	100

Commercial squab producers often feed less whole yellow corn during the summer months than during the winter months.

Certain minerals must be fed to pigeons, calcium requirements for egg production being relatively high, and calcium and other minerals being necessary for growth and bone development in squabs. A satisfactory formula for a mineral mixture is as follows: medium-sized crushed oystershell, 40 per cent; limestone or granite grit, 35 per cent; medium-sized hardwood charcoal, 10 per cent; bone meal, 5 per cent; ground limestone, 5 per cent; salt, 4 per cent; Venetian red, 1 per cent. Keep this mineral mixture before the birds in a hopper or pan.

Keep clean drinking water available at all times, but be sure to use fountains or water containers into which the birds cannot get their feet to contaminate the water.

Feed pigeons by hand or in hoppers. If you feed by hand, at each feeding time put just enough feed in an open trough so that all feed will be consumed in less than an hour. Feed two or three times daily, the amount to feed each time being determined by the number of birds, season of the year, rate of laying, and number of squabs to be fed by the parents. If you feed three times daily, less should be fed each time than when you feed twice daily, but three feedings per day usually give better results. Hopper feeding saves labor and all the breeders get a chance to get all they want. Do not fill the hoppers too full, or feed will be wasted. Feed about 1 day's supply at each feeding. Never allow feed to spoil or become stale, either in hand or in hopper feeding, because spoiled feed may give rise to diarrhea or other digestive disturbances.

The amount of feed consumed by pigeons is determined by their size, the number of eggs and squabs produced, and other factors. Only a general statement can be made here. A pair of well-bred Kings, producing at least 12 squabs in a year, will consume about 100 lb. of grain. The annual feed consumption of other breeds varies according to their size and other factors mentioned previously. About 7 or 8 lb. of grain are required to produce a 1-lb. squab, including the feed used by the parent.

Housing Pigeons. The housing requirements of pigeons are relatively simple, the minimum requirements being an abundance of fresh air, plenty of sunlight in the house, and adequate space within the house for the pigeons. Locate the house on well-drained soil so that water will drain away from the yard or "fly" attached to the house. Face the house south. In southern sections of the country an open-front type of house is satisfactory, while in northern sections a closed-front type is usually necessary. In all sections of the country, however, all walls except the front should be tight to prevent drafts.

Most pigeon houses are built of pine or other lumber, although cinder blocks and other materials may be used. One of the simplest and least expensive types of houses to build is the shed-roof type, with an 18- or 24-in. projection or hood attached at the top in front to keep out driving rain and snow.

Since about 4 sq. ft. of floor space, or 5 sq. ft. for the largest sized breeds, should be provided for each pair of breeders, the size of house is determined by the number of breeders kept. If you intend to keep

20 pairs of breeders, the floor area of the house should be from 80 to 100 sq. ft. If you intend to keep several hundred pairs of breeders, divide the house into pens large enough for each pen to accommodate from 25 to 40 pairs of breeders. Better results are usually secured when each pen contains about 25 pairs of breeders. Every other partition dividing the pens should be wire rather than lumber in order to provide as much light as possible at the rear of the pens.

Build the house about 6 ft. high in the rear and about 7 or 8 ft. high in front in order to provide adequate ventilation. A house for about 20 pairs of pigeons should be about 8′ × 10′ or 10′ × 10′. A long house divided into pens should be at least 15 ft. deep, to allow for an aisle at the back of the house wide enough to use a wheelbarrow

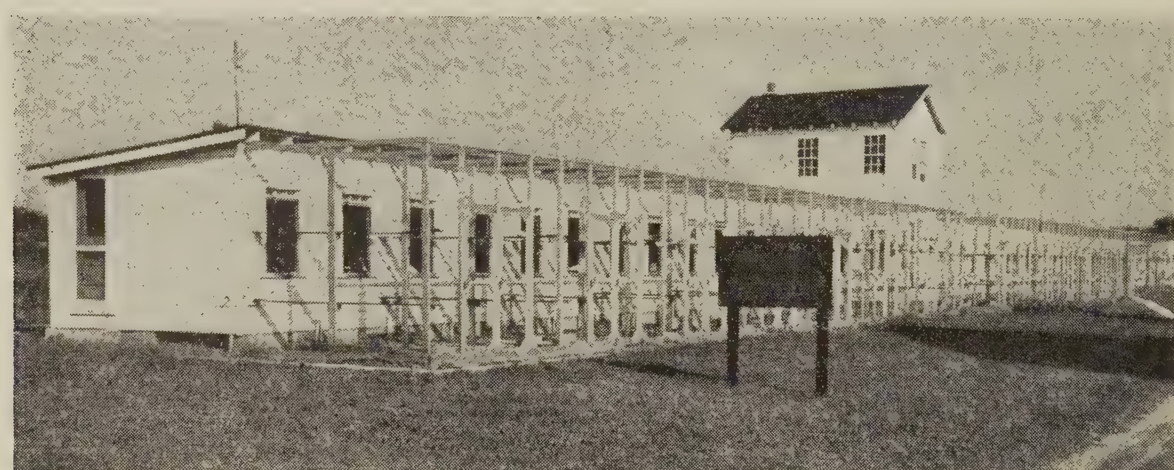


Fig. 215.—New Jersey pigeon breeding house at Millville, similar to houses used at commercial pigeon plants. (*C. S. Platt, New Jersey Experiment Station.*)

for feeding and cleaning. The aisle also allows you to go to any pen in the house without disturbing the other pens. This is very important, especially during the breeding season. If the walls are insulated, be sure that they are ratproof.

Build ratproof concrete floors, the same as for laying houses described in "Successful Poultry Management." Cover the floor with about 1 in. of sand. Use hay, straw, tobacco stems, or other material for litter. Keep nesting material available in one corner of each pen.

Provide a double nest for each pair of breeders. A 5-in. board along the front of the nest keeps the nesting material and the squabs in the nest. Provide a 6-in. landing board in front of each double nest. Build each double nest separately, so that it can be removed readily and cleaned thoroughly. Provide nest bowls for each nest. The fronts of the nests may be wired over and the landing board hinged so that the double nest, with nest bowls removed, may be used as a compartment for making up matings.

In northern sections of the country, it is sometimes advisable to heat the pigeon house during the winter season to prevent squabs from becoming chilled.

Providing and Equipping Yards. A yard or "fly" attached to the south side of the house makes it possible for the pigeons to exercise. Make the top of the yard about 7 ft. high. The yard for each pen should be the width of the pen and about 20 ft. long. Use 1-in.-mesh wire for the outside, to keep out rats and sparrows, and for the partitions between yards. Around the outside, put the wire 12 in. below ground level and bend it at right angles away from the yard and have 12 in. of wire extending horizontally outward. This arrangement is also necessary to keep out rats.

Be sure the ground used for yards is well drained and put about 4 in. of sand or fine gravel on top to ensure dryness. If the pigeon exit door into the yards is above ground level, place a lighting board at the bottom of it on the inside and outside. Place an 8-in. or 10-in. running board along each side of each yard near the top.

Provision must be made for the pigeons to take a bath to keep them in good health and free from external parasites. For a small flock, a wide pan about 5 in. deep is satisfactory. Since the pigeons will drink water from the pan, it should not be left in the yard more than about 2 hr. each day. If you have numerous breeding pens, build a long concrete trough at the front end of the yards. Make it about 5 in. deep and 2 ft. wide, with a drain at the lower end. Drain the trough twice daily and flush it out thoroughly once daily.

Keeping House and Yards Sanitary. You cannot expect to secure satisfactory results from your pigeon enterprise unless the house and yards are kept clean. Most diseases affecting pigeons are filth-borne. The most effective way of combating disease and keeping pigeon mortality at a minimum is to maintain sanitary quarters for them.

At frequent intervals, remove the litter from the house and rake the droppings off the sand. Renew the sand on the floor at least twice a year. After each house cleaning, scrape the concrete floor and wash it, as well as the partitions and nesting equipment, with hot lye water, in the same manner described for disinfecting turkey brooder houses in Chap. 6. Nests and nest bowls must be cleaned when they do not contain squabs. Keep the yards clean by raking off the droppings at intervals and change the sand at least once a year.

Keep a lookout for mites around the nests and landing boards, especially in hot weather. If any are found, apply crude oil, creosote oil, or carbolineum thinned with kerosene. For lice, treat each bird with pinches of sodium fluoride as with other classes of poultry.

Since pigeons are subject to several diseases affecting other poultry, preventive measures and possible treatment given in previous chapters may apply to pigeons.

Marketing Squabs. Squabs attain market size in about 4 weeks, the exact time depending on the size of the breed, the kind of diet fed,

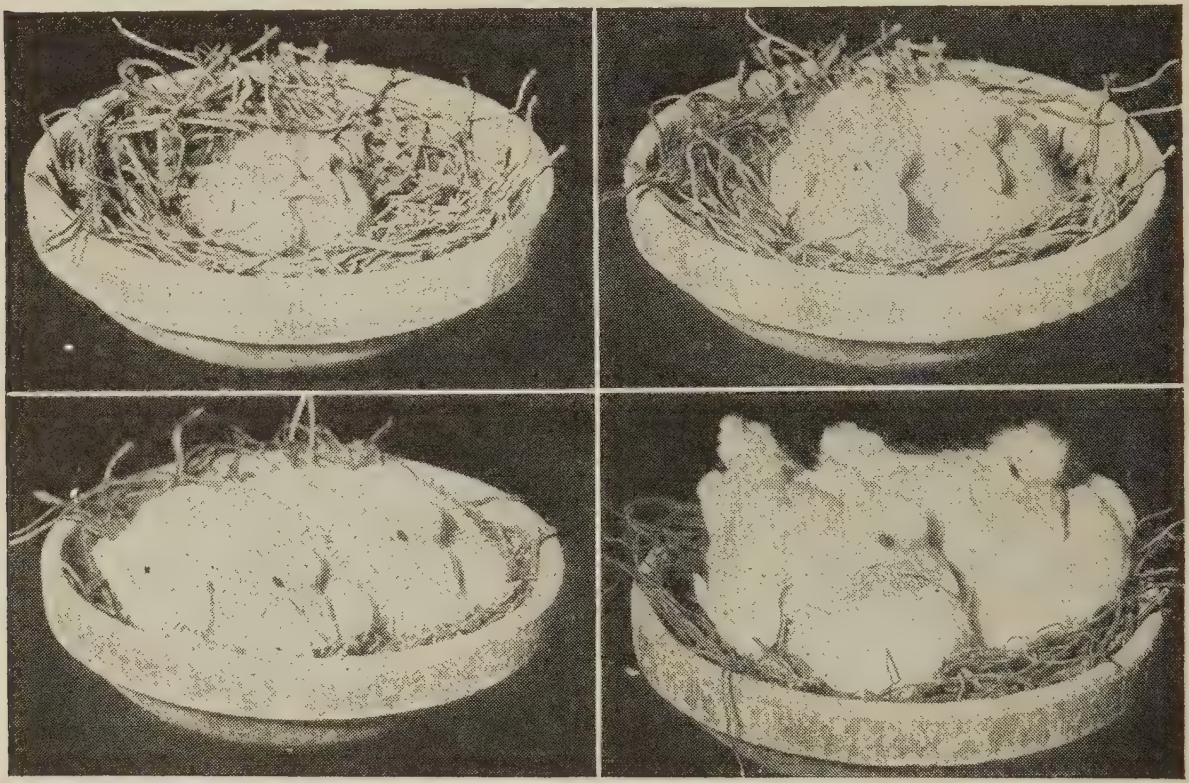


Fig. 216.—Top left, squabs 24 hr. old. Top right, 1 week old. Bottom left, 2 weeks old. Bottom right, 3 weeks old. (*U.S., Department of Agriculture.*)

and methods of management. Market them as soon as they are ready, or they lose their baby fat and the flesh begins to get hard. To determine the proper time for marketing, examine the underside of the wing; if pinfeathers are present, the squab is not quite ready for market; if the pinfeathers are in their sheaths but not fully open, the squab is in prime condition for market.

If squabs are to be sold alive, gather them from the nests after feeding time in order to avoid excessive shrinkage while the birds are in transit. They are usually shipped in crates or boxes, care being taken not to overcrowd them.

Some squab producers sell their dressed squabs direct to consumers, but most of the commercial producers ship them to wholesale or retail buyers in the larger cities or to hotels, country clubs, and restaurants.

When marketing dressed squabs, gather them from the nests the evening before they are to be killed and dressed so that there will be no feed in the crops at killing time. Feed in the crop is very objectionable because it lowers the price and hastens spoilage of the flesh if the dressed squabs are held for any length of time.

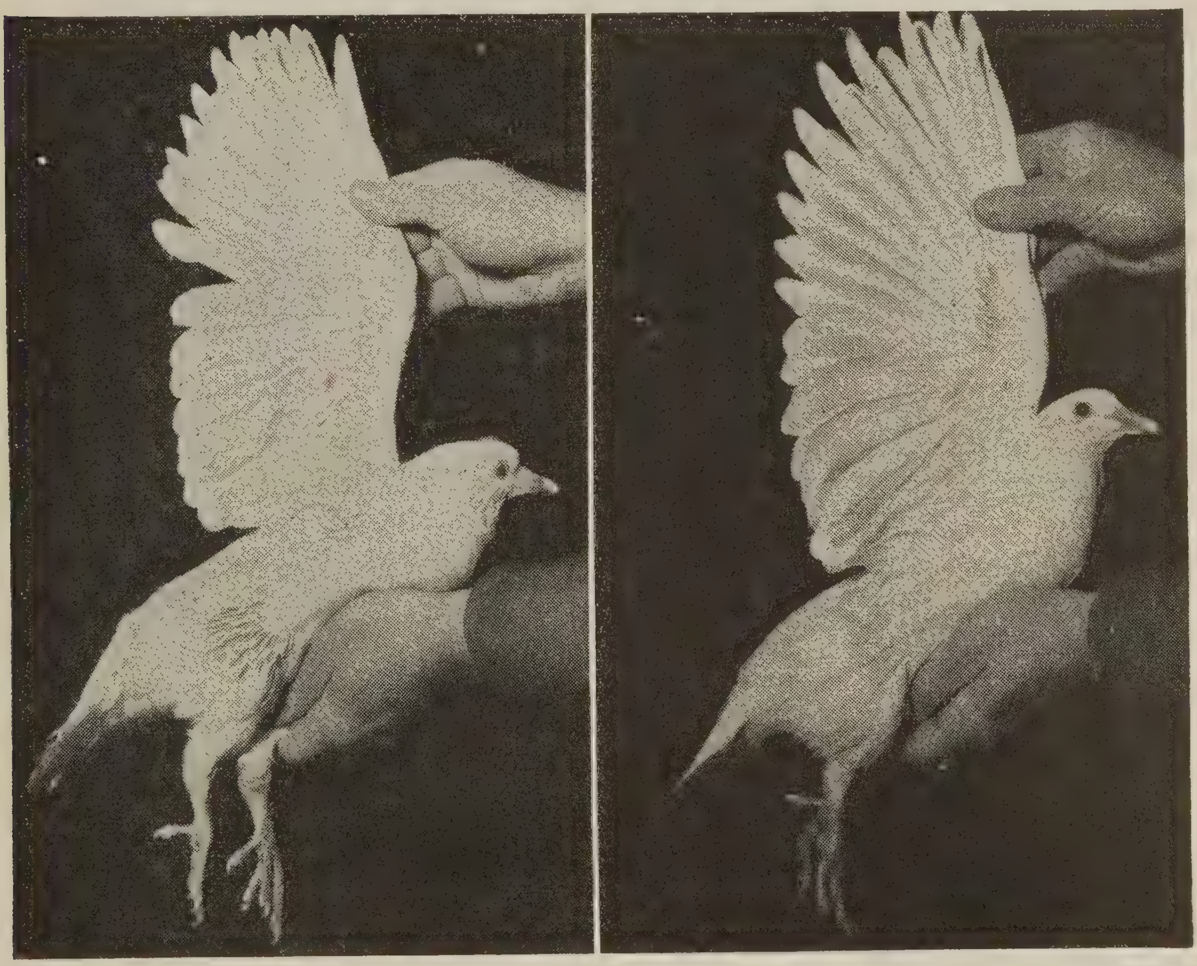


Fig. 217.—Left, squab showing pinfeathers on underside of wing; not quite ready for market. Right, squab 4 weeks old; fully feathered under the wing and, therefore, ready for market. (*A. R. Lee and S. K. Haynes, U.S. Department of Agriculture.*)

Killing and plucking is done in much the same manner as with other poultry, described in preceding chapters. Cool the dressed birds promptly and thoroughly to remove all body heat, about 3 hr. in ice-cold water being required. Wash and pack in clean boxes, tubs, or barrels with cracked ice, a layer of ice then a layer of squabs with heads down and another layer of ice and then squabs until the container is filled, ending with a layer of ice, over which fasten a burlap covering securely. The trade in quick-frozen squabs has increased, as with other classes of poultry. The quick-freezing method is described in Chap. 7. Squab prices are usually best from November through February.

3. Raising Peafowl

The peafowl is a very ornamental bird and is often used to adorn private estates or public zoological gardens and is sometimes kept on farms. Of the two wild species of peafowl, the Indian and the Javan, the Indian species is the one kept in this country.

FIG. 218.—Indian peafowl, male and female. (*Fish and Wildlife Service, U.S. Department of the Interior.*)

Only a brief description of the plumage of the Indian peafowl can be given here. Male: the head and neck are metallic green; the back is bronze; the upper tail coverts, which form the very long and beautiful train, are green with numerous large ocelli, each of which is ringed with blue and bronze; the thighs and wings when closed are buff; the flight and tail feathers are cinnamon brown. Female: the head is chestnut, the mantle green, and the back is brown indistinctly mottled with buff; the throat and fore part of the neck are white; the breast is brownish black, fringed with green; the wing coverts are coarsely mottled with buff and black.

There is also a white variety, which makes a most attractive display on a green background.

Peafowl enjoy living in the open and prefer to roost in trees. Because peafowl are inclined to be noisy, especially at night, the roosting place should be arranged some distance from dwellings. If you must confine your peafowl, because they fly readily, provide large grassy runs and a tall, open shed for a roosting place. Once established in their new home, peafowl are not inclined to stray away.

The full plumage of the male, including the beautiful train, is not attained until the third year. The train is molted in the late summer and is not fully replaced before the end of winter.

FIG. 219.—The white peafowl presents a gorgeous spectacle on a green background. (*U.S. Department of Agriculture.*)

Since peafowl are polygamous, four or five peahens may be mated to one male.

Most peahens seldom lay during their first year, but during the second and third years lay a few eggs, thereafter increasing their production until five to nine eggs are laid each year. If peafowl are not confined to a pen or yard, thick shrubbery is suitable for nesting. If the eggs are removed from the nest as they are laid, the peahen may lay a second and even a third clutch of eggs.

The incubation period is from 28 to 30 days. Peahens are usually allowed to incubate their own eggs or turkey hens may be used, since both make good mothers. Peahen eggs may also be incubated artificially in much the manner as chicken eggs, in which case turkey hens are usually used as foster mothers for the young peafowl.

One of two methods may be followed in rearing young peafowl. They may be reared by their peahen mother in the open or by the peahen mother or turkey foster mother confined to a large coop for about 6 or 7 weeks. The critical period in rearing the young is during that period, hence the reason for confining the mother that long. Place the coop in a well-lighted and sheltered place. It should have a wired floor of ¼-in.-mesh hardware cloth and should be kept on short grass and be moved frequently. Keep the young peafowl confined in the coop with the mother during the first week and after the seventh week release the mother.

Young peafowl may be fed the same as young pheasants; this subject is discussed in the next chapter. Young peafowl soon learn to eat grain and may be fed millet or mixed small grains. When they are grown they may be fed whole grains. Feed chopped greenstuff and vegetables regularly and keep grit, broken oystershell, and water available at all times. Peafowl are very fond of insects and if plenty are available, little extra feeding is necessary, especially after the peafowl are fairly well grown. Keep them out of the garden, where they may do some damage.

SUMMARY

1. The Pearl guinea is the variety usually kept on farms in this country.
2. One male may be mated to four or five females.
3. Guinea chicks are usually raised by natural methods, chicken hens making better "mothers" than guinea hens.
4. Feed the guinea chicks a chick starting mash the first 2 or 3 weeks, then change to a chick growing mash. After the young guineas are about 6 weeks old, feed cracked corn and wheat.
5. Among the most popular kinds of pigeons for squab production are White King, Runt, Red Carneau, Giant Homer, French Mondain, and Swiss Mondaine.
6. Be sure all birds in a pen are properly mated because an unmated male is liable to break up the nest of a mated pair.
7. Provide about 4 or 5 sq. ft. of floor space per pair of breeders, depending on their size.
8. A pair of good breeders should produce 12 squabs per year.
9. A pair of such breeders will consume approximately 100 lb. of feed per year, the largest varieties consuming more and the smaller varieties consuming less feed.
10. The squabs are fed "pigeon milk" by both parents; squabs should be ready to market at about 4 weeks of age when they average about 1 lb. each.

11. Keep the pigeon house, yard, or fly sanitary by regular cleaning and renew the water in the watering pans or troughs frequently to prevent the spread of disease.

12. The critical period in rearing young peafowl is the first 6 or 7 weeks, during which time they are fed in similar fashion as young pheasants, as outlined in the next chapter.

12. Raising and Conserving Game Birds

GAME birds of various kinds are raised in all parts of the United States for food and pleasure, the sport of shooting game birds being indulged in by thousands of city folk as well as by farmers. The upland game birds most abundant at present include the Ring-necked pheasant, Bobwhite quail, Hungarian partridge, and wild turkey. There are other kinds of pheasants, quail, and partridge, however, that are suitable for food and sport. These are discussed later, as well as certain species of grouse, wild ducks, and wild geese, which are also highly prized for food and for the sport of shooting.

From the standpoint of increasing the supply of game birds, two problems are involved, propagation and conservation. The propagation of game birds is carried on by such agencies as the Fish and Wildlife Service of the United States government and by state game commissions in practically every state in the country.

Thousands of youth projects in propagating game birds are carried on every year and thousands of farmers carry on a regular program aimed to increase the numbers of game birds on their farms. The conservation of wildlife is also very important; unless it is undertaken many species of valuable game birds are liable to become extinct, as has been the case with the Passenger pigeon.

This chapter discusses briefly various methods of propagation and conservation that should be carried on much more vigorously than at present to ensure a continuous supply of the following game birds for farmers and their city cousins:

1. Raising Pheasants
2. Raising Quail
3. Raising Partridge
4. Raising Grouse
5. Raising Prairie Chicken
6. Raising Wild Turkeys
7. Controlling Parasites and Diseases
8. Practicing Conservation of Wild Game Birds

Securing Licenses and Permits. In most states there are laws and regulations affecting the propagation of game birds, game-bird breeders being required to take out licenses. These licenses and information concerning laws relating to game-bird propagation may be obtained from your state game commission, addresses of which are given in the Appendix. In many states, usually under certain restrictions, artificially propagated game birds of one kind or another may be sold for food. In order to buy or sell migratory waterfowl, including wild ducks, geese, and swans reared in captivity, it is necessary to secure Federal permits. These permits may be obtained from the Fish and Wildlife Service, U.S. Department of the Interior, Chicago, Ill.

1. Raising Pheasants

The true pheasant does not have a white ring around the neck, a characteristic common to the Chinese and the Mongolian species.

FIG. 220.—Mongolian pheasant. (*Biological Survey.*)

These three species have been much mixed in breeding and at different times have been crossed with the greenish-colored Japanese species. The ordinary wild stock found so abundant in certain parts of the United States, especially in the Dakotas, Wisconsin, and Minnesota is in reality a hybrid.

Apparently one of the earliest importations of pheasants into this country was made about 1790, since which time many other importations have been made. Pheasants have become widely distributed. The cock pheasant crows, for the most part, in the spring and early summer and usually mates with more than one female. She makes a shallow nest in the ground under the cover of vegetation and lays from 8 to 13 eggs, the incubation period being from 23 to 25 days.

Besides the Ring-necked pheasant, there are also the Golden, Amherst, and Silver pheasants. The incubation period of the Golden and Amherst pheasants is about 25 days and of the Silver pheasant about 26 to 28 days.

Selecting and Managing Breeding Stock. As a pheasant breeder, always keep in mind the importance of selecting the very best birds for mating purposes. Yearling hens mated to two- and three-year-old cocks usually give results as good as, or better than, any other kind of mating, although some breeders mate two- and three-year-old hens with yearling cocks.

If you wish to buy breeding stock, be very sure to order from a reliable breeder, because many poor and old birds are offered for sale every year by persons who have practically no scruples concerning prices charged for the quality of stock they offer for sale. In purchasing any breeding stock, keep it quarantined in a separate pen for 2 or 3 weeks to avoid the danger of an outbreak of disease in your own flock.

If you raise your own breeding stock, select the earliest maturing vigorous hens in September or October before you sell any stock. Aim to select the best birds for yourself, because the quality of young stock raised each year depends largely on the quality of the breeding stock used. Place the early-maturing hens selected in a holding pen by themselves.

About November is the proper time to select the males you intend to keep for future breeding purposes. Select large vigorous males with good body type and color and put them in a holding pen by themselves.

The females and males at selection time should be in prime condition, with tail feathers fully grown.

Catching and Handling Breeders. Use every precaution possible in catching the birds at selection time so that they will not be disturbed unduly. If birds are kept in small, completely enclosed holding pens, catching each bird with a fish-landing net having a 15-in. ring and a 5-ft. handle is a fairly simple matter. A better method, however, especially if the enclosed pen is fairly large, is to use a catching crate into which the birds are driven.

In large holding pens, the most effective way of catching the birds is to drive them into a wire or fishnet trap set up in one corner of the pen. In open pens the trap must be covered with wire. Make the trap about 8 ft. wide and about 15 ft. long. Drive the pheasants into the trap very slowly, not over 25 at one time, and, after closing the trap with the free end of the wire netting, catch the birds individually with a fish-landing net. Handle each bird slowly and carefully.

Making Up the Matings. Make up your matings about a month before you want eggs. In northern latitudes, where snow is liable to be on the ground until some time in April, make up your pens the latter part of March. In southern latitudes, the fore part of March is a good time to make up the matings.

Many pheasant breeders mate five or six females to one male, but some of the most successful operators mate as many as twelve or more females to one male.

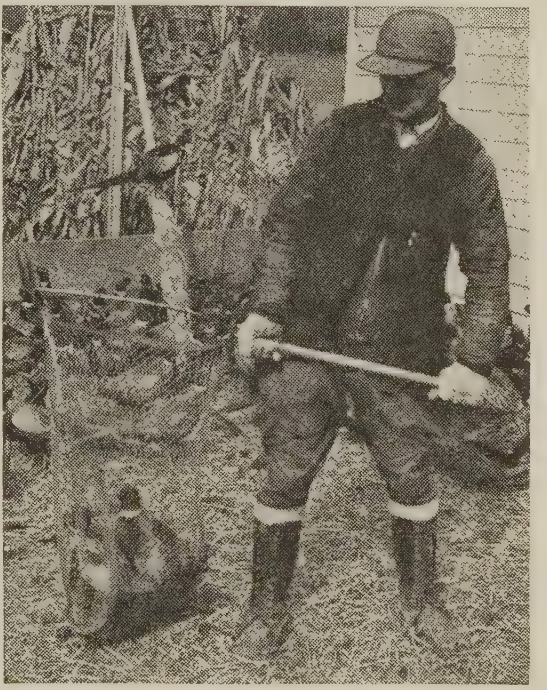


FIG. 221.—Showing method of catching pheasants with a fish-landing net. Here attendant is selecting males for breeding purposes. (*Pennsylvania Game Commission.*)

Constructing Breeding Pens. Locate the breeding pen in a sheltered spot on well-drained soil. A southern slope with trees on the north and west sides makes an ideal location. If no natural windbreak is available, use brush or cornstalks on the north side to give some protection against winds. Plenty of vegetation, such as clover, alfalfa, and redtop, provides cover for the breeders, in which they can hide. Never keep pheasants on bare or, especially, on foul soil.

The size and arrangement of the breeding pen to be provided depends to some extent on the number of breeders you keep and whether or not you intend to expand your enterprise. If you keep but one mating of five to six or twelve or more females and one male, perhaps the best arrangement is to build a completely enclosed movable pen with a covered shelter at one end. If there are several matings, you may build a movable pen for each mating and enclose them all in a large yard surrounded by a fence 7 ft. high. Several matings may be allowed to run together in a large yard, in which two or three shelters are provided; or there may be one large shelter at one end of the yard.

A pen $8' \times 12'$ or $8' \times 16'$ is satisfactory for a mating of a male and five or six females. Use 1-in. mesh No. 19 gauge chicken wire netting around the sides, burying the wire in the ground at least 6 in. to keep out all predatory animals. Put the same kind of netting over the top to keep out owls, crows, cats, and other animals. Around all sides at the bottom of the fence put burlap or boarding 18 to 24 in. wide to discourage the birds from continually walking back and forth along the fence looking for a place to get out. This also lessens the danger of the birds being frightened by animals passing by on the

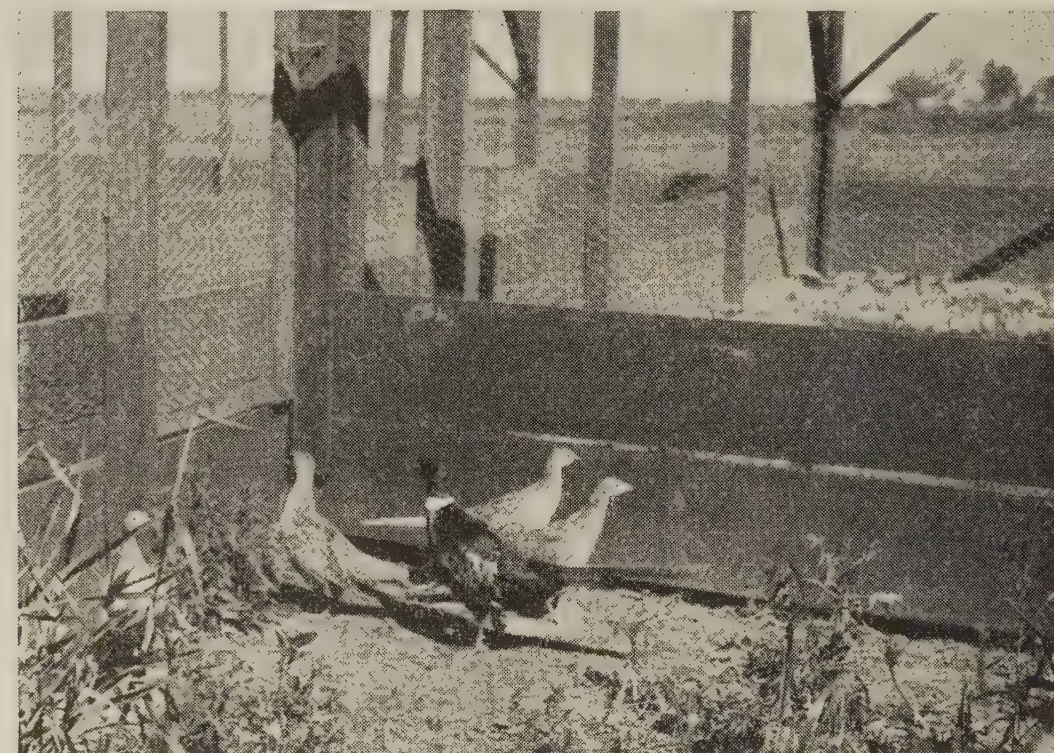


Fig. 222.—Many pheasant breeders mate five or six females to one male, but some mate twelve or more females to one male. This illustration shows a breeding pen of Ring-necked pheasants belonging to the Turlock chapter of the Future Farmers of America in California. Several pens are maintained on the school grounds. (*Turlock Chapter, F.F.A., California.*)

outside. At one end of the pen, provide a shelter. This open-front shelter is a good place in which to keep the feed hoppers and water fountains. Put evergreen branches in the corners and around the sides. Place a roost in the pen high enough so that the pheasants can see what is going on outside, thus greatly reducing the chances of unduly frightening them. Movable pens 3 ft. high on the sides can be used by the small-scale pheasant breeder. Move the pen at least three times during each breeding season and be as careful as possible not to disturb the birds unduly.

Use cinders packed down hard for the floor of the breeding pen.

Do not use litter, but alfalfa hay put in heaps gives the pheasants something to pick at and may provide some feed.

Pheasant breeders who operate on a commercial basis usually use larger pens. Some of them use an open shed at the north end of the

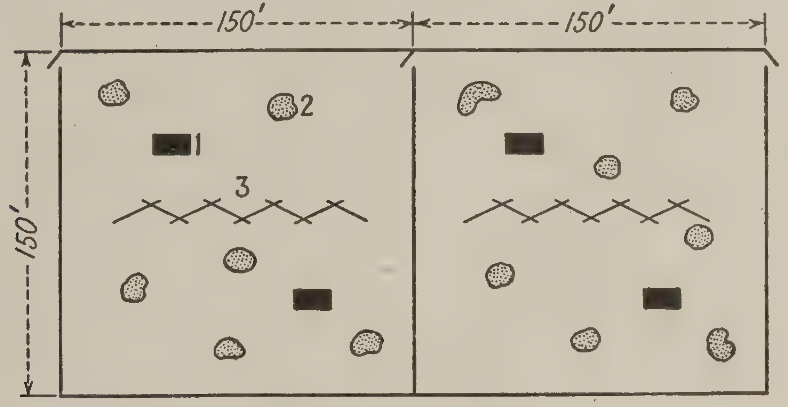


FIG. 223.—A field 150′ × 150′ with (1) shelters, (2) feeding stations, and (3) stake and rider fences, will accommodate about 9 cocks and 95 hens. (*After Game Conservation Society, Inc.*)

pen running the width of the pen. This provides a place for feed hoppers, so that feed is always available to the pheasants regardless of the weather. Others use large pens, 150′ × 150′, accommodating

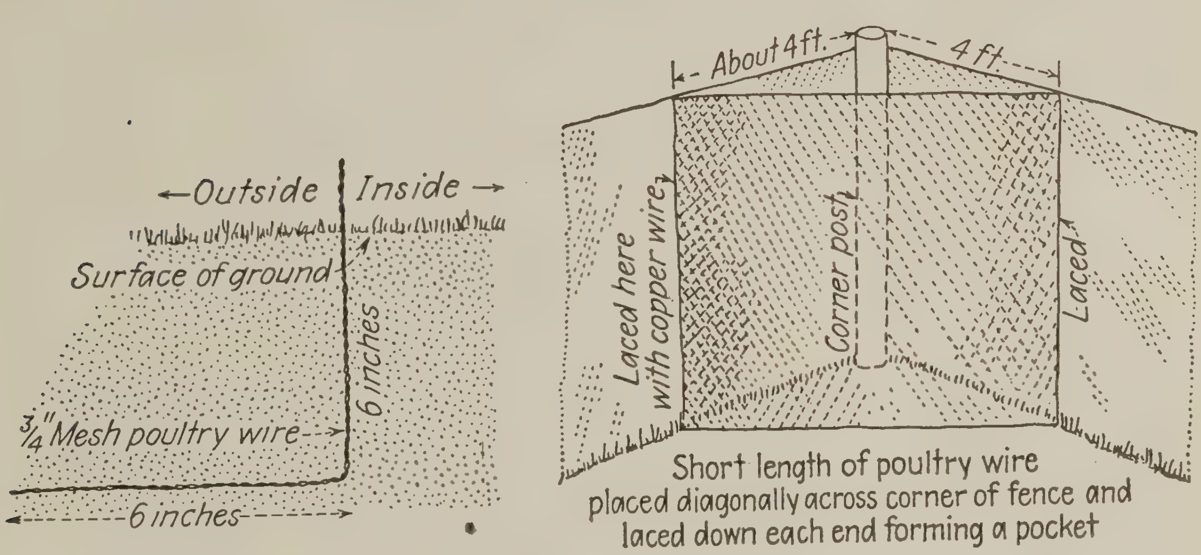


FIG. 224.—Left, showing method of burying wire to keep burrowing predatory animals from gaining access to yards. Right, showing method of fencing corners to keep cats and dogs from getting into the yards by climbing the corner posts. (*Game Conservation Society, Inc.*)

about 95 hens and 9 cocks. Provide at least 200 sq. ft. per bird. Shelters are placed in each pen and several bunches of evergreen branches are placed in different parts of the yard, as shown in Fig. 223.

The fence for a large yard containing several matings should be carefully constructed, or many birds are liable to be lost. When the fence lines are staked out, plow a furrow along each line, throwing the furrow outward from the pen. The fence should be 7 ft. high, with corner and tee posts set firmly in the ground. Stretch a roll of 6-ft. width of 2-in. mesh poultry netting along each side of the pen, with the top of the netting 7 ft. above the ground. Since poultry netting is manufactured in 150-ft. rolls, the netting can be taken down readily without being cut, because the same breeding pen should not be used 2 years in succession. Fasten a 2-foot width of 1-in. mesh No. 19 gauge netting to the posts under the 6-foot width of 2-in. netting, allowing 6 in. of the 1-in. netting to drop in the furrow and another 6 in. to be turned outward from the pen, as shown in Fig. 224. This prevents burrowing predatory animals from gaining access to the pen. Since cats climb wooden corner posts readily, it is well to place a piece of poultry netting across each corner of the pen, as shown in Fig. 224. A mixture of 20 parts of crude furnace oil and 1 part by weight of spirits of turpentine sprayed on a 4-ft. strip of ground just outside the fence around the breeding pen may help to keep foxes away. In order to prevent the depradations of crows, hawks, and owls, set pole traps of the "jump" type on the corner fence posts and on posts located inside the pen. A better type of bird trap, however, is shown in Fig. 225.

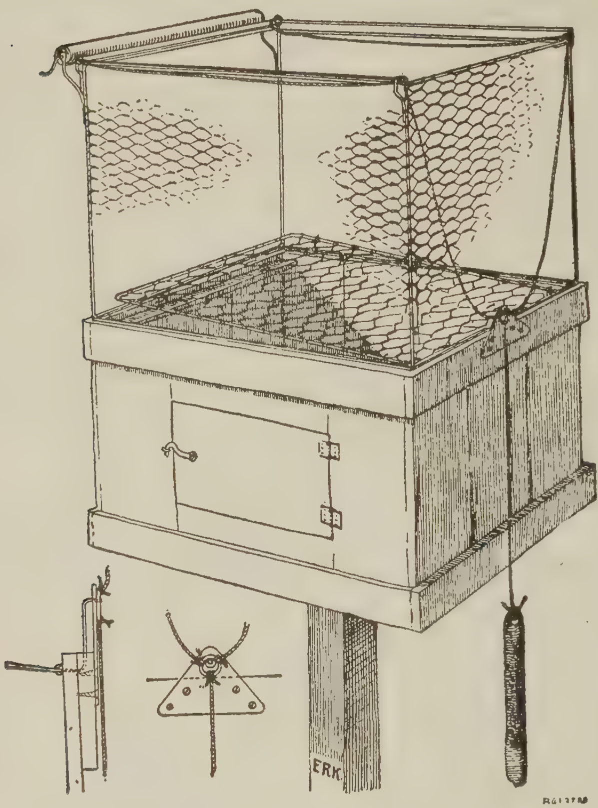


FIG. 225.—Basket trap for hawks. A live chicken or pigeon is kept in the lower part of the trap for bait. A hawk endeavoring to strike the fowl depresses the wire netting floor of the upper part of the trap, releasing the weight, which pulls over the top of the trap the rolled curtain shown at the left. (*W. L. McAtee, Fish and Wildlife Service, U.S. Department of the Interior.*)

Pheasants are nervous creatures. In order to secure satisfactory results, take every precaution to avoid excitement. Besides providing protection from enemies, do everything possible to make them feel "at home" in their quarters.

Preventing Flight in Breeders. Pheasant breeders who do not use completely enclosed breeding pens use any one of three methods of preventing breeding birds from flying out of the pen—clipping the primaries of one wing, brailing one wing, or pinioning one wing.

Clipping the first ten primary feathers of one wing is the simplest method of preventing flight and is the method usually employed by commercial pheasant breeders. The clipped feathers are replaced by new ones toward the latter part of July, so that at that time the birds must be put in the holding pens.

Brailing to prevent flight consists of attaching a leather brail to one wing, which prevents it from being fully extended for flight. The

Fig. 226.—Showing method of brailing pheasants to prevent flight temporarily. (*Game Conservation Society, Inc.*)

split ends of the brail are passed around the shoulder of the bird, the ends meeting at the top of the shoulder, as shown in Fig. 226. The long unsplit end of the brail is then passed between the second and third flight feathers and brought around until it meets the two split ends of the brail. Adjust the three ends in order to give the wing a little play but not sufficient to permit full flight. Then secure the three ends with a brass split pin, turning the ends of the pin away from the pheasant's body, as shown in Fig. 226. Shift the brail from one wing to the other three or four times each year.

Pinioning prevents flight permanently and for that reason should never be done to a bird that may be liberated for propagation in the wild or for shooting. If pheasants are not going to be liberated at any time, however, pinioning is an effective method of controlling flight. Pinioning pheasant chicks is very simple and consists of snipping off the outer section of the wing when the chicks are from 4 to 7 days old, as shown in Fig. 227*A*. Dip the remaining cut end in tannic acid in powdered form to prevent bleeding or use glycerite of tannic acid, consisting of a mixture of one part liquid tannic acid and four parts glycerin.

To pinion an adult bird, tie a cord tightly around the outside joint of the wing, as shown in *B* and *C*, Fig. 227. With a pair of strong, sharp scissors, cut the joint close below the cord and apply tannic acid or glycerite of tannic acid immediately. Remove the cord a few days later, when the wound is practically healed. Do not pinion adult pheasants to be used as breeders just prior to the breeding season or egg production and fertility will be affected.

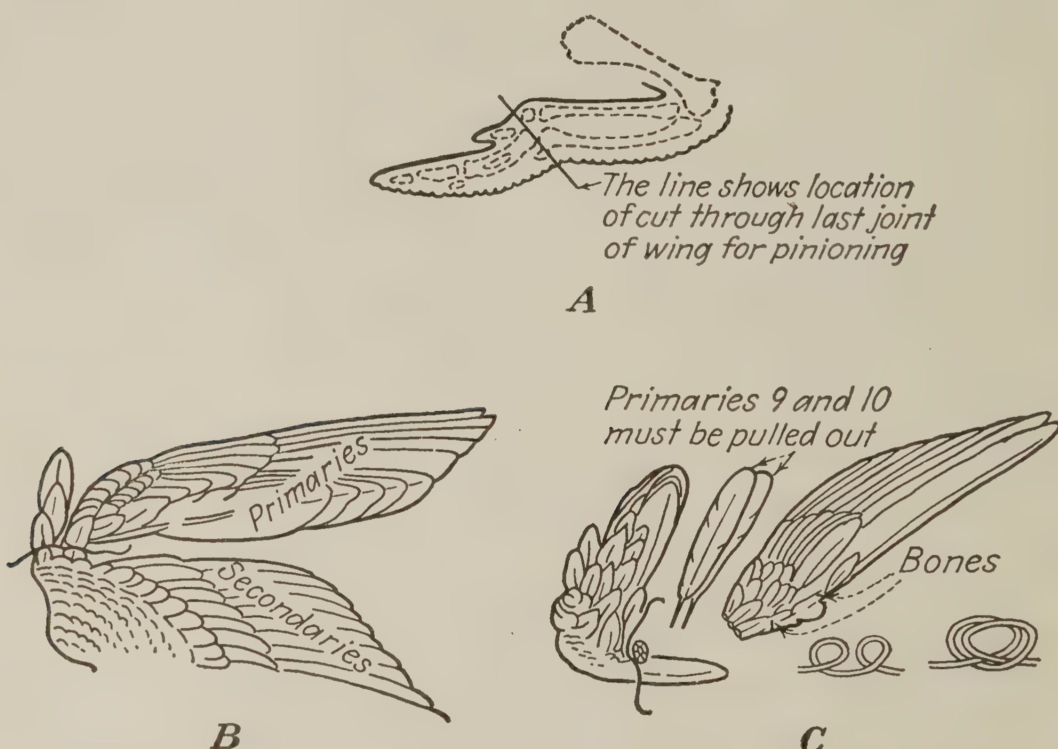


Fig. 227.—Showing method of pinioning to prevent flight permanently. (*A*) Chicks 4 to 7 days old may be pinioned as indicated. (*B*) Upper side of adult wing showing flight feathers separated from secondaries and tied just within point of amputation. (*C*) Underside place of amputation and form of knot tied. (*Game Conservation Society, Inc.*)

Using Artificial Lighting to Stimulate Egg Production. Pheasants normally start laying about the first of April in most parts of the country, usually a little earlier in southern than in northern sections. You can get your breeders into good egg production at least 1 month earlier, however, by putting them under artificial lights. A 50-watt bulb in each pen and morning lights turned on automatically so as to provide 13 hr. of combined artificial light and sunlight give satisfactory results. Put the females under lights about 1 month before you want eggs and put the males under lights about 1 month earlier than the females are to be lighted, especially in northern latitudes.

Preventing Egg Eating. Pheasants normally lay up to 50 eggs during the breeding season. In some cases egg eating may develop into a vicious habit, especially in large open pens. Since the females are apt to lay their eggs anywhere in the pen, collecting the eggs three or four times daily is advisable. In very cold weather, collect them every hour or oftener to prevent chilling or freezing. Attaching "pick guards," "hen specs," or similar devices to the beaks, as is sometimes done with laying hens to prevent feather picking and cannibalism, has been found to be of considerable assistance in reducing egg eating among pheasants. Providing plenty of feed hoppers well distributed throughout the breeding pen is also helpful.

Incubating the Eggs. When you collect the eggs from the breeding pens, go over them carefully and eliminate all cracked, thin-shelled, very small, very large, and poorly shaped ones. Store the good eggs that are to be incubated in a room with a temperature of about 55°F. and a relative humidity of about 60 per cent. If you only have a few eggs, one of the simplest ways of storing them is to put them small end down in about 1 in. of sand or bran and tilt them at an angle of about 45 deg. from the vertical position. If you have a large number of eggs, construct a holding rack of proper size and place the eggs in the rack at an angle. Turn the eggs daily and do not hold them longer than 10 days. In fact, the fresher the eggs are when set, usually the better the hatch.

Hatching Pheasants under Hens. Pheasant eggs may be incubated under pheasant hens, bantams, or any general-purpose breed of chickens. For suggestions on managing the setting hens, see Chap. 3 on incubating turkey eggs under hens, or Chap. 11 on incubating guinea eggs under hens. For pheasant eggs, however, keep the nest moist, because pheasant eggs require more humidity during the fore part of the incubation period than chicken, turkey, and guinea eggs.

Hatching Pheasants in Incubators. Pheasant eggs may be incubated with success in incubators, providing you use the right kind of incubator and follow the proper directions. For the most part, the operation of the incubator is the same as for incubating chicken eggs, described in Chap. 4 of "Successful Poultry Management," or for incubating turkey eggs, described in Chap. 3 of this book.

To ensure good hatchability, turn pheasant eggs at least four times daily up to pipping time, the first turning early in the morning and the last turning late at night.

Some makes of incubators seem to give better results in hatching pheasant eggs than others. Therefore, if you intend to incubate pheasant eggs artificially, get the advice of an experienced pheasant breeder or write to the state game commissioner of your state (see Appendix).

Incubating pheasant eggs artificially differs slightly in two respects from incubating chicken and turkey eggs. In most still-air incubators, the temperature on a level with the top of the eggs should be maintained steadily at 102.5°F. for the first 15 days and at 101.5°F. for the rest of the incubation period. During the fore part of the incubation period, the relative humidity should be about 70 per cent and during the latter part of the incubation period about 60 per cent. In air-agitated incubators, maintain a temperature of 99.5°F. throughout the entire incubation period and keep the relative humidity at about 63 per cent. Most experienced pheasant breeders prefer to incubate eggs in an air-agitated incubator up to the time the embryos begin to pip the shell and then move them to a still-air incubator, where the pheasant chicks are hatched. At moving time the pipped eggs are sprinkled with hot water.

Leave the pheasant chicks in the hatching tray or nursery tray for about 24 hr. after they have hatched. When moving them to the brooder, be sure they do not become chilled.

Rearing the Young Stock. Pheasant chicks hatched under hens are usually brooded by them in much the same manner as domestic baby chicks. If numerous hens are used for natural incubation, the simplest arrangement is to set the hens in coops out in the field where the pheasant chicks are to be reared. Otherwise, the hen and chicks are moved from the scene of hatching to the rearing field after the chicks are thoroughly dry. Pheasant chickens hatched in incubators are practically always reared with brooders, such as used for brooding domestic baby chicks and turkey poults.

Preparing a Suitable Rearing Area. In order to rear pheasant chicks most successfully, the land must be as free as possible from contamination by disease organisms and at the same time provide an abundance of insect life and have plenty of shade. Slightly rolling, well-drained land is preferable to flat land. Do not use land that was used by pheasants or any kind of poultry during the previous 2 years. Grass, clover, alfalfa, or other vegetation is satisfactory but should be mowed three or four times during the early part of the rearing period. Adjacent to the rearing area, grow a crop of oats, corn, buckwheat, and sunflowers to provide feed and shade.

The area needed for rearing pheasants is naturally determined by the number of pheasants you intend to raise each year. For a brood of about 15 pheasants each year, you could use a movable pen about $8' \times 16'$ enclosed with wire netting over the top and around the sides with 2 ft. of boarding at the bottom of all four sides. This pen should be moved to fresh ground frequently, however, so that the total area of land needed for rearing your brood of 15 should be at least 10 times the area of the pen.

On the other hand, you could rear your brood of 15 chicks with a hen confined to a coop, the chicks being given access to the rearing area after the first few days of confinement to a small enclosure attached to the coop. The coop should be moved to fresh ground every day, so that a considerable area is necessary during the rearing season. The whole area should be fenced in, as for brooding several broods in a large field.

Fencing in a field for rearing several broods is done in practically the same way as fencing in the breeding range described previously. Place the brooding coops in rows about 60 ft. apart, leaving a space about 45 ft. wide between the first row of coops and the fence along one end of the field and about 15 ft. between the last row of coops and the other end of the field. This permits moving the coops about 20 times in one direction before reversing. Before placing the coops in the field, mow strips at least 5 ft. wide and 60 ft. apart and place the coops on the strips. Cutting each strip frequently, especially during the early part of the rearing period, keeps the grass, clover, or other vegetation short and helps to keep the pheasant chicks from getting wet or lost. Alongside each 5-ft. rearing strip, grow a 6-ft. strip of oats, corn, buckwheat, and sunflower.

Brooding Chicks with Hens. Different styles of brooding coops may be used for confining the mother hen and for sheltering the pheasant chicks. Plans for a satisfactory brooding coop are given in Fig. 228.

The V-boards, which form the enclosure attached to the front of the brooding coop for keeping the chicks therein for the first few days, consist of two boards, each 3 ft. long and 12 in. wide, hinged together at one end. For the first day after the hen and chicks are placed in the coop, the boards are folded together and placed against the front of the coop to keep the chicks within the coop. Then they are placed with the free ends against each side at the front of the coop to form a V-shaped enclosure for the next 2 days. After the third day, remove the V-boards.

For raising one brood of chicks, the brood coop may be placed in a completely enclosed movable pen; that is, a pen with a wire top and sides. In this way practically all predatory animals are kept away from the pheasants. The coop and the pen should be moved at frequent intervals to avoid soil contamination and to give the pheasants access to fresh sources of feedstuffs.

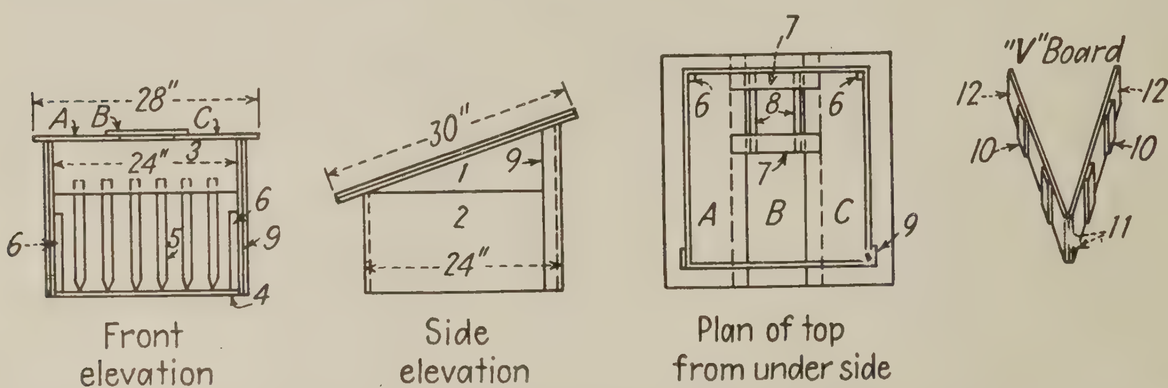


Fig. 228.—Construction details of coop and attached V-board enclosure for rearing pheasant chicks with a domestic hen. (*Game Conservation Society, Inc.*)

When placing several brooding coops in the field to raise considerable numbers, be sure that they are set on leveled ground and bank the earth up around the outside of the four sides of each coop and the V-boards. This is necessary to avoid drafts and to prevent the chicks from escaping.

If the hen that hatched the chicks is used to brood them, she is very likely to accept them when placed in the brooding coop. However, if another hen is chosen for brooding, be sure that she will accept the chicks. Place two or three chicks under her and observe her carefully for a few minutes. If she hovers the chicks and seems contented, she likely can be given the balance of the brood.

Visit the coop at sundown the first three or four nights, and, if all chicks are not under the hen, put the stray ones under her. Some chicks are inclined to hide in the corners of the coop until they learn to go under the hen to keep warm.

If a sudden rainstorm comes up, visit the coop to make sure the chicks return safely. After the fourth day the chicks will have learned the call of the mother hen and will return safely to the coop when called, so the V-boards may be removed safely. If, however, some chicks do not find their way back to the coop at sundown, search the area and listen carefully for a peeping sound. After the V-boards have been removed, move the coops to fresh ground frequently. Shift the coop slowly so as not to injure any of the chicks. The coops should be moved several times during the season, the actual number of times being determined by the nature of the soil, how fast the vegetation on the rearing strips grows, and the weather. Toward the latter part of the rearing season the coops should be moved every week or so. Throughout the rearing season the strips of oats, corn, buckwheat, and sunflowers provide some feed and shade, which is so essential.

Fig. 229*A*.—Brooder houses for brooding pheasant chicks on a commercial plant. (*New York Conservation Department.*)

Brooding Chicks Artificially. Pheasant chicks may be reared with brooders in colony brooder houses to which outside runs are attached. Electric brooders, coal-burning brooder stoves, and wood-burning brooder stoves have been used with success. Large-scale operators sometimes use a continuous hot-water system of brooding. Others brood their chicks in battery brooders for 2 weeks and then transfer them to other brooders. For the average pheasant raiser, however, the colony brooding system is more suitable. The management of the brooder and of the brooding house in rearing pheasants is practically the same as for brooding turkey poults, described in Chap. 4.

Have your brooder operating properly 2 days before you put the chicks in the brooder house. The temperature at the outside edge of the hover or canopy should be 95°F. The temperature around the feed hoppers and water fountains should be 80°F. This is very important, because it encourages the chicks to come out from under the brooder in search of feed and drink. For the first few days place a guard around the brooder to keep the chicks from straying away from the brooder and piling up in the corners of the house. Move the guard farther and farther away from the brooder, until in about 3 days it can be dispensed with.

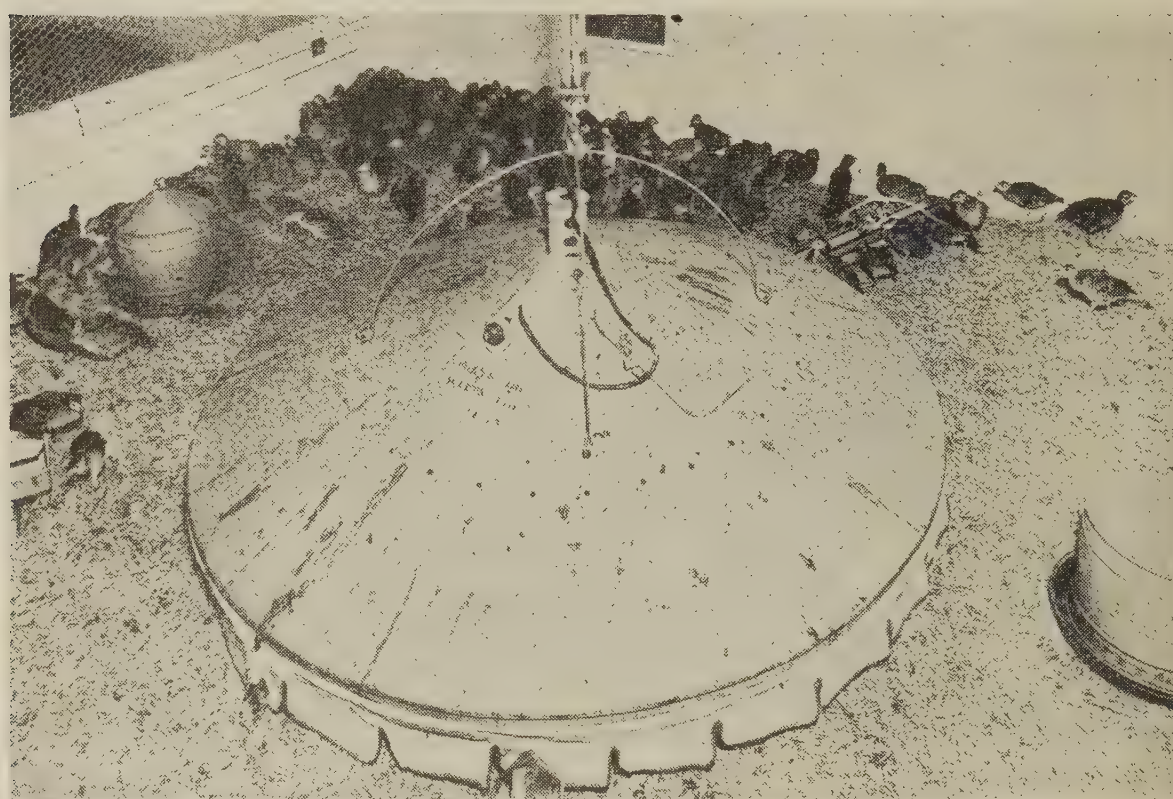


FIG. 229*B*.—Using an electric brooder for raising pheasants in a continuous brooder house at New York State Wildlife Research Center, Delmar. (*Bureau of Conservation Education, New York Conservation Department.*)

Provide at least ½ sq. ft. of floor space per chick. Overcrowding tends to induce feather picking.

When the chicks are 3 days old, give them access to a small outside run attached to the house, if the weather is fine. The enclosure should be made of ½-in. mesh netting 3 ft. wide, and each run should be as wide as the brooder house and about 15 ft. long. When the chicks are about 10 days of age, enlarge the outside run to at least 20 times its former size, and when the chicks are about 4 weeks old give them twice as much room. When the chicks are about 7 weeks old, shut them out of the brooding house and give them access to the rearing field.

Pheasant chicks may be brooded in brooder rooms equipped with hardware-cloth floor in the same manner as poults, described in Chap. 4. The outside runs may also be equipped with hardware-

FIG. 230.—Wire floor sun porch attached to brooder. (*New York Conservation Department.*)

FIG. 231.—Young pheasants on range at Gynnbrook State Game Farm, Maryland. (*E. Lee Le Compte, Maryland Game and Inland Fish Commission.*)

cloth floors. An increasing tendency, however, is to use starting brooders heated with electricity for about 1 week and then transfer the chicks to the regular brooder house. The starting brooders are equipped with wire floors and are raised 2 or 3 ft. off the ground.

Whatever particular method of brooding has been employed, artificial heat is not necessary after about 7 weeks, at which time the chicks are transferred to rearing fields. Small-sized rearing fields may be wired over the top, but large rearing fields are not covered over with wire.

Preventing Feather Picking and Cannibalism. If pheasant chicks are overcrowded in the brooder house, and especially if they do not have access to vegetation in the runs or rearing field, they are liable to develop the vicious habit of feather picking. Sometimes this leads to cannibalism. Therefore, avoid overcrowding the brooding house and rearing areas. Plenty of vegetation will help to prevent the vice from becoming a serious menace. "Pick guards" or "hen specs" attached to the beaks at 6 weeks of age is a good preventive measure. Adding up to 2 per cent salt to the diet will also help to keep this bad habit under control. A very effective preventive is to remove about one-fourth of the upper beak. A special electric debeaker is on the market which makes the operation simple.

Setting Traps. The most satisfactory kind of trap for catching hawks, owls, and other flying enemies is the basket trap shown in Fig. 225. Birds that are a benefit to agriculture may be released if caught in a trap of this kind. If you cannot get or make such a trap, place No. 2 pole traps of the jump type on tall posts located in different parts of the field to catch owls, crows, and hawks. Set the traps at a tension so that they will not catch song birds. Besides burying 1 ft. of the fence underground, as described previously, to keep out foxes, skunks, coyotes, and other predatory animals, it is sometimes necessary to set traps outside the fence. For a satisfactory trap, see Fig. 263.

Catching Escaped Pheasants. Growing pheasants develop their wing feathers relatively early and at 4 weeks of age can fly over quite a high fence. Since a number of pheasants that fly over may not return, losses during the season might become excessive. To avoid this possibility, take a piece of 2-in. poultry netting 6 ft. wide and attach it to the outside of the fence around the rearing field, as shown in Fig. 232. The stray birds are driven into the trap, caught, and returned to the rearing field. Prevent a lot of fence flying by clipping the primaries of one wing of each pheasant under 6 weeks of age. Help keep down excessive losses due to fence flying by patrolling the outside of the fence every morning and evening, inspecting the fence carefully and watching for signs of depredations.

Feeding Breeding and Young Stock. The problem of feeding pheasant breeding and young stock is much simplified nowadays as compared with former times, because several feed companies have developed diets in mash and pellet form that supply the nutritional requirements of birds of different ages. This has been made possible as a result of experimental work carried on by some of the feed companies and by research conducted at several state experiment stations.

Feeding the Breeding Stock. During recent years notable advances have been made in the formulation of diets for breeding pheasants. The feeding of dry mashes and pellets instead of old-fashioned moist mashes is not only laborsaving but more sanitary.

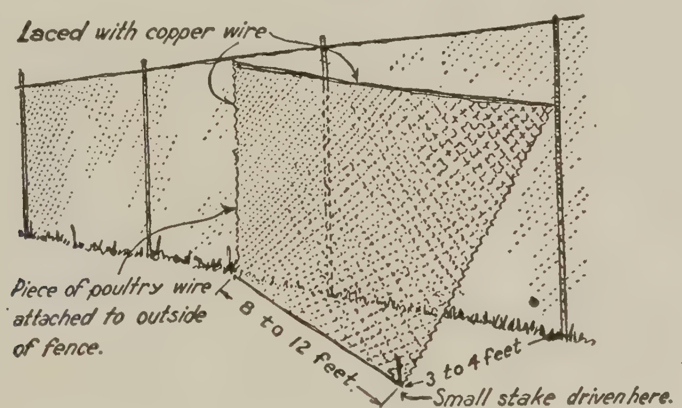


Fig. 232.—Fence trap for catching escaped pheasants. (*Game Conservation Society, Inc.*)

During the winter months feed your breeding stock an all-mash maintenance diet such as is recommended for quails, given later. Another method of winter feeding the breeding stock prior to the laying season is to feed them grower pellets and a game-bird fitting ration, the pellets being fed in one hopper and the fitting ration in another hopper. One advantage in using the game-bird fitting ration rather than scratch grain as a supplement to pellets is that the fitting ration contains molasses, which increases the palatability of the ration.

Beginning about 1 month before you want pheasants to start laying, feed an all-mash breeding diet, such as is given in Table 83 for quail breeding stock. Make the change from the winter-feeding diet to the laying diet gradually by mixing the two together for 4 or 5 days, gradually increasing the proportion of the laying diet in the mixture. More and more pheasant breeders use a laying diet in pellet form. There is less likelihood of wastage of feed when pellets are fed than when mash is fed. In both cases, however, do not fill the feeding hoppers over two-thirds full. If you have been feeding mash and want to change to pellets, feed a mixture of mash and pellets for about 1 week and then feed pellets only. Move the hoppers at least once weekly to avoid soil contamination.

Be sure that plenty of water is available for the breeding stock at all times. Snow is never a substitute for water. Place the water fountains on wire platforms, as for turkey poults, illustrated in Chap. 4.

Provide medium-sized granite grit and oystershell in self-feeding hoppers.

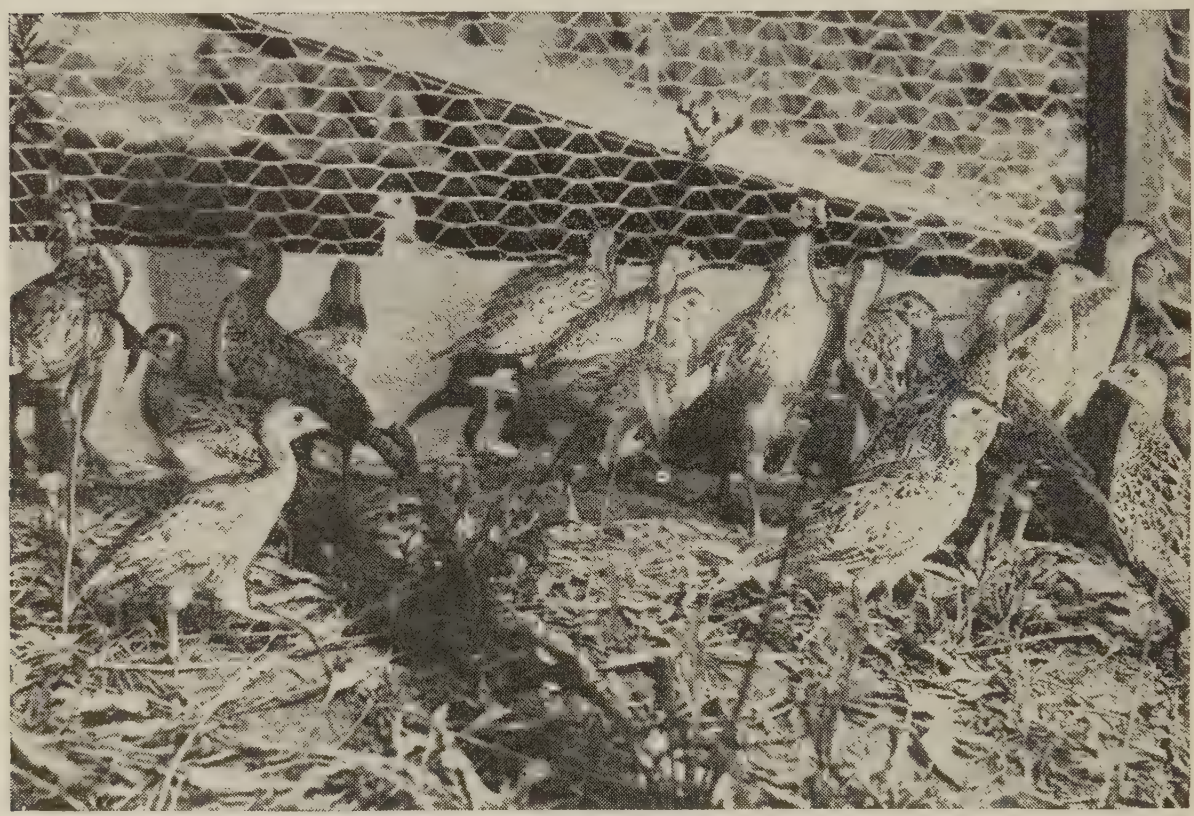


FIG. 233.—For most satisfactory results in growth, young pheasants should be fed mashes or pellets containing a relatively high protein content. (*New York Conservation Department.*)

Keep the feed and grit hoppers and water containers in the shelter provided for the breeding stock.

Feeding the Young Stock. For one or a few broods of pheasant chicks, finely crumbled hard-boiled egg may be fed mixed in a mash for about the first week and then a mash fed during the rest of the growing period. Commercial pheasant raisers, however, usually start their chicks on a starter mash containing from about 24 to 28 per cent protein and at about 8 weeks change to a grower mash containing less protein. Some raisers start feeding pellets at about 5 or 6 weeks and after about 8 weeks feed pellets only. A recent innovation in feeding practice is to feed crushed pellets during the first 5 or

6 weeks and then grower pellets for the rest of the growing period. Use low hoppers that are readily accessible.

In addition to the mashes or pellets that are fed to pheasant chicks, medium-sized hard granite grit and medium-sized oystershell should be provided in separate self-feeding hoppers. Also, provide plenty of clean drinking water, changing it twice a day. Keep the water fountains sanitary at all times.

Formulas that have given satisfaction in feeding pheasant chicks to 8 weeks of age are given in Table 82.

TABLE 82. DIETS FOR GROWING PHEASANTS, POUNDS PER HUNDRED
(Nos. 1 and 2, by L. C. Norris, L. J. Elmore, and R. C. Ringrose, Cornell University; No. 3, by W. C. Skoglund, Pennsylvania Experiment Station)

Ingredient	No. 1	No. 2	No. 3
Wheat flour middlings	20.0	20.0	12.5
Wheat bran	10.0	10.0	15.0
Ground yellow corn	16.75	11.0	11.2
Ground oats	10.0	10.0	10.0
Alfalfa leaf meal	10.0	10.0	5.0
Dried skim milk	15.0	15.0	12.5
Fish meal	8.25	8.25	2.75
Meat scrap	3.0	6.0	11.05
Soybean oil meal	3.0	6.0	19.5
Salt	0.5	0.5	0.5
Cod-liver oil (400 A.O.A.C.)	1.0	1.0	0.25
Pulverized limestone	2.0	2.0	
Tricalcium phosphate	0.5	0.25	
Total	100	100	100.25

Diet No. 1 given in Table 82 contains 24 per cent protein, diet No. 2 contains 27 per cent protein, and diet No. 3 contains 28 per cent protein.

Data on growth, amount of feed consumed, and pounds of feed consumed per pound gain in body weight on a biweekly basis and for the 8-week period are as follows, the diet used in this case being No. 3 in Table 82:

Period	Day-old	2 weeks	4 weeks	6 weeks	8 weeks
Weight per bird, grams	21.32	69.14	170.79	338.00	503.22
Feed consumed per 100 birds, pounds	.....	39.75	109.39	214.97	355.18

At the completion of the growing season the pheasants are transferred to holding pens with wire netting over the top. The protein content of the diet should be reduced and scratch grain, such as a mixture of two parts whole wheat and one part cracked corn, should be fed. Feed fresh-cut alfalfa, cabbage, or other green feed once daily.

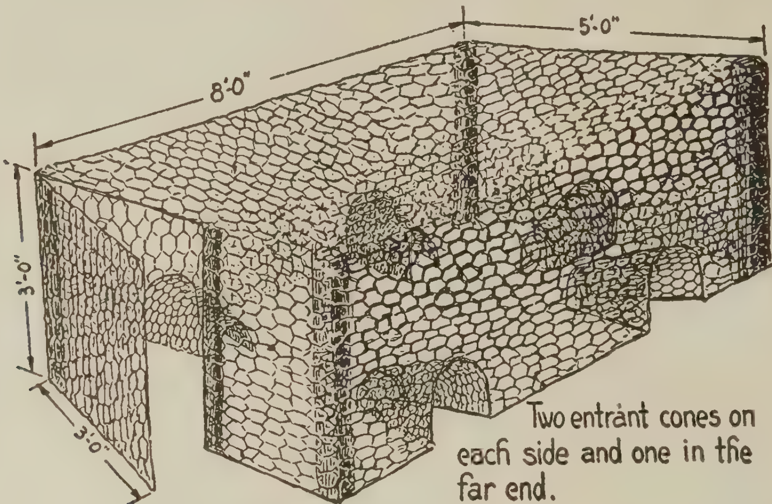


FIG. 234.—Pheasant stake trap. (*Game Conservation Society, Inc.*)

Catching, Holding, Marketing, and Liberating Pheasants. One way of catching pheasants in the fall to remove them to holding pens is to trap them in wire-constructed traps such as shown in Fig. 234. About 2 weeks before the birds are to be trapped, mow strips about 10 ft. wide across the rearing field, no mowed strip, however,

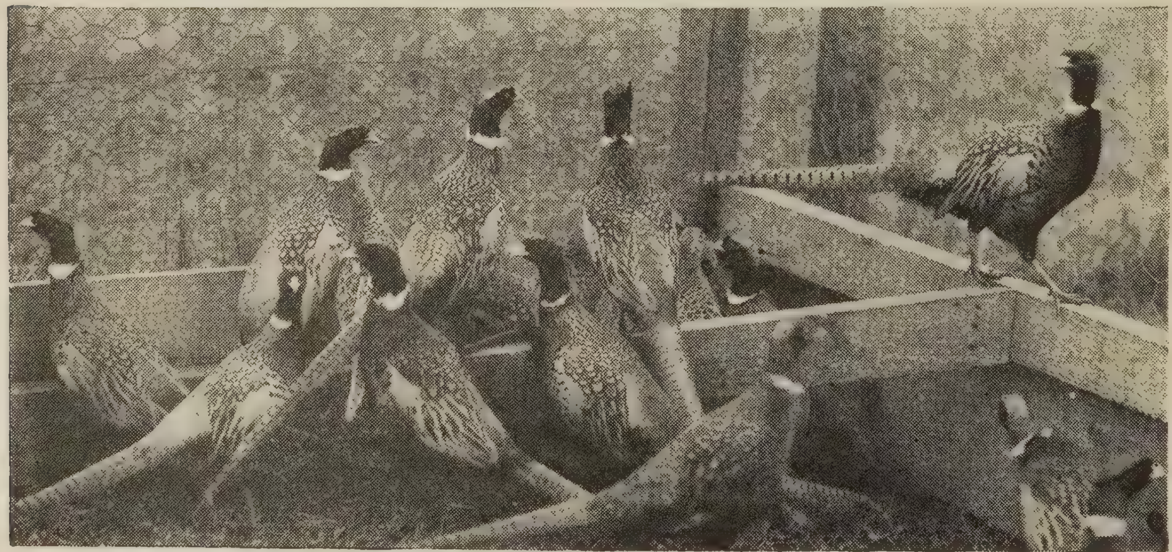


FIG. 235.—Ring-necked cockerel pheasants ready for release. (*New York Conservation Department.*)

to be within 50 ft. of the fence. Have someone walk along in front of the mower to flush the pheasants, so that none will be injured. The catching traps are placed on these mowed strips and the coops are moved a little distance each day toward the traps until each trap is surrounded by coops. The day prior to trapping, feed the pheasants very little. The morning of the day the birds are to be trapped, place all the feed inside the traps and after about an hour the pheasants may be caught and moved to the holding pens.

Many pheasant raisers use a fish-landing net, shown in Fig. 221, for catching the grown pheasants to transfer them from the rearing field to the holding pen. This is a quick and simple method, but care must be taken not to injure the birds.

Holding. A holding pen covered with wire netting is desirable to enable you to go over the birds you raise each year and from which

FIG. 236.—Open holding pen in Minnesota. (*Minnesota Department of Conservation.*)

you wish to select a few breeders for your own use. The holding pen is also useful for selecting birds for marketing and as a place in which to hold over winter the birds that are to be liberated in the spring. Provide 40 sq. ft. of ground space per bird for those held over the winter period. Provide shelters either at two corners or at the end of the holding pen and keep the floor of the shelter well littered with clean straw. Keep plenty of cover in the pen, such as brush or cornstalks.

Marketing. The principal demand for pheasants is for breeding and stocking purposes. Select your own breeding stock first in order that you may continue to produce the best possible quality of young stock from year to year. Sales of breeding stock are made to other pheasant breeders, state game departments, private preserve owners, and game-farm operators.

For stocking purposes pheasants may be sold in the fall or spring, prices in the spring being higher than in the fall.

Shipping coops should be light but strong and should provide ample room and plenty of ventilation. They should also be convenient for handling. If birds are to be in transit more than 24 hr., provide feed and water in separate containers.

Pheasants not entirely satisfactory for breeding or stocking purposes could be sold to hotels or restaurants, although the demand for them is rather limited. *Before selling any birds for food, however, it would be well to consult your state game commission because some states have stringent*

FIG. 237.—Enclosed holding pen in Pennsylvania. (*Pennsylvania Game Commission.*)

regulations pertaining to the sale of wild or artificially propagated game birds for food. Canning pheasants for home use is practiced to some extent.

Liberating. The most satisfactory time to liberate pheasants for stocking purposes is in the spring of the year as soon as the snow has disappeared and the ground has become reasonably dry. For best results, liberate the birds in the ratio of one cock to three hens. As soon as green vegetation appears in sheltered places, especially near dense bushes of some kind, take the coop containing the pheasants to these places with as little disturbance as possible. Take special precautions not to frighten the birds. Liberate them in the evening so that they will settle there for the night. Scatter a little grain under the bushes and gently open the door of the coop facing toward the bushes. Allow the birds to leave the coops of their own accord. Take every precaution not to allow the birds to be unduly disturbed by dogs or other animals and scatter some scratch grain around the bushes every other day for about 10 days after liberation.

2. Raising Quail

There are several species of quail in the United States but the Bobwhite quail is the most numerous of all the species. In certain sections of the country, however, there are many California and Valley quail in the wild state and considerable numbers are propagated artificially. Then there are the Gambel, Mountain, and Scaled quail and the Texas, Mexican, Masked, and Mearns Bobwhite quail.

Fig. 238.—Bobwhite quail covey roosting. (*K. A. Wilson and E. A. Vaughan, Maryland Game and Inland Fish Commission.*)

The artificial propagation of quail, especially the Bobwhite and California species, has become quite an important enterprise in this country. The Bobwhite quail is the best known of our upland game birds. In the Northern states it is ordinarily called "quail" but in the Southern states it is commonly referred to as "partridge." In its natural habitat it ranges widely over the eastern half of the United States.

Selecting and Managing Breeding Stock. Select breeders early in the fall and place them in separate pens isolated from the rest of the flock. Select a few more breeders than you will use in the spring to provide for any losses that may occur during the winter. Yearling and two-year-old birds make good breeders. Each year, select future breeding stock from matings that have given good results with respect to fertility and hatchability but among these progenies keep only the large, healthy, vigorous, and early-maturing birds. A quail breeder who carries on pedigree-breeding work is able to select future breeders from among the progeny of his best matings because quail are monogamous in their mating habits, that is, one male mates with a single female. The results secured from one experiment showed, however, that somewhat higher fertility was secured from matings of two females and one male than from matings of one female and one male.

Fig. 239.—Valley quail. (*California Department of Natural Resources.*)

The male and female are about the same size, averaging about 6 oz. The male can be distinguished from the female by the white markings on the face and throat; the female has yellowish-brown markings on these parts.

Continued close inbreeding, such as mating brother and sister, should be avoided because it tends to lower hatchability.

If you want to introduce new blood, purchase breeding stock from a quail breeder or trap some wild quail. Keep such birds quarantined for about 3 weeks in order to avoid the possibility of spreading disease in your flock.

Constructing Breeding Pens. Since quail mate in single pairs, it is necessary to provide a breeding pen for each pair in order to secure best results. In the wild state, of course, each pair selects its own nesting place and mated pairs do not molest other mated pairs. Under conditions of domestication, however, provide as much privacy as possible for each pair because quail are very sensitive to disturbances.

Locate the breeding pens in a relatively isolated spot surrounded by a high fence so that cats, dogs, and other animals will not excite the birds. When you go to feed or tend the birds, give them some warning by singing or whistling. Any unusual noises may result in lowered egg production.

A double-compartment breeding pen is shown in Fig. 240. If several matings are made up every year, the four-unit breeding pen shown in Fig. 241 is more economical and satisfactory.

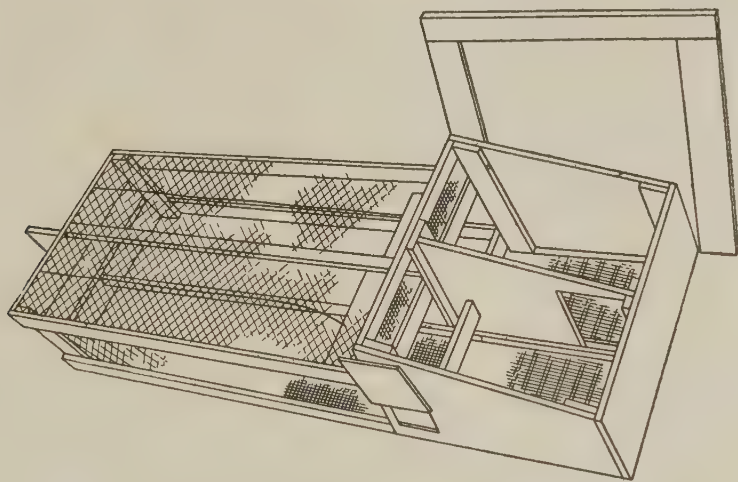


Fig. 240.—Double-compartment breeding pen for two pairs of quail. (*R. B. Nestler and W. W. Bailey, Fish and Wildlife Service, U.S. Department of the Interior.*)

The equipment for each laying pen is shown in Fig. 242. The nest box shown there provides some degree of privacy for the female. A dust box containing dry sand is important to prevent infestation by lice. Should the quail become infested, however, dust them with

Fig. 241.—A four-unit quail breeding pen. (*R. B. Nestler, Fish and Wildlife Service, U.S. Department of the Interior.*)

small pinches of sodium fluoride over different parts of the body, especially around the vent and beneath the shoulder joints.

Stimulating Egg Production. Put enough fine excelsior in the nest box to make a good nest. Because the hen is quite sensitive when she is in a laying condition, remove the eggs once a week.

Mark the first egg she lays and use it as a nest egg throughout the laying season to induce her to keep laying in the nest box.

Laying usually starts about the first of April in Southern states and somewhat later in Northern states, the exact time depending somewhat on the weather and feeding methods employed. Upward of 60 eggs per hen are quite common.

Incubating the Eggs. The incubation period of quail eggs is 22½ days and in most cases the hatching is completed within about 4 hr. It is desirable to gather quail eggs once a week. Handle them very carefully, because the shells are thin and easily broken. Store

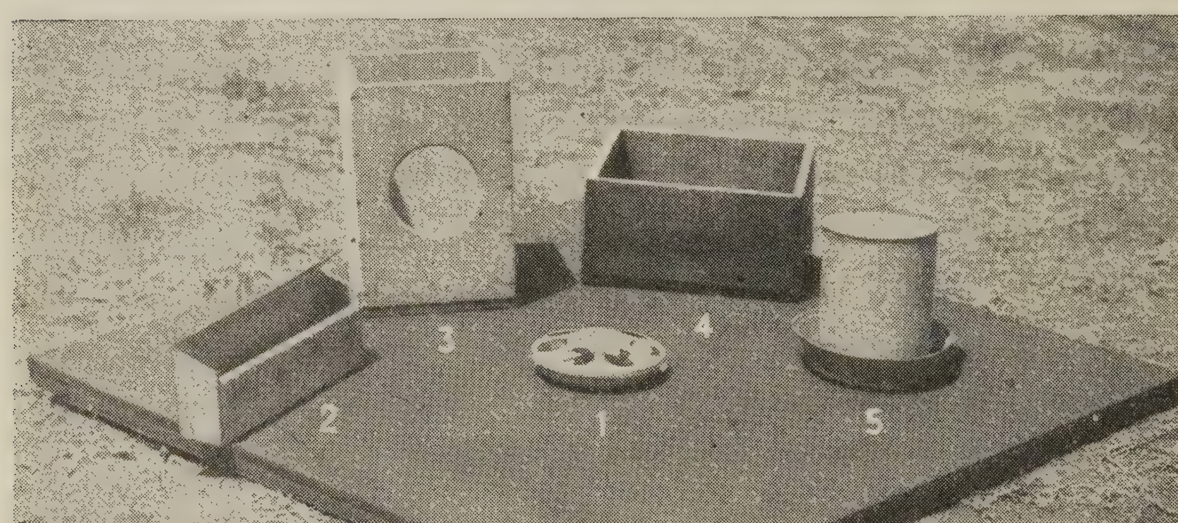


FIG. 242.—Equipment for each quail breeding pen: (1) Feeder, 6 in. in diameter, with removable top, for feeding grit; (2) wall feeder 2⅛ by 10 by 5 in. high, for feeding dry mash; (3) nest box; (4) dust box; (5) water fountain, 2-qt. capacity. (*R. B. Nestler and W. W. Bailey, Fish and Wildlife Service, U.S. Department of the Interior.*)

them small end down in a room having a temperature of about 55°F. but keep in mind that usually the fresher they are when set for incubation, the better the hatch. It is better, therefore, to set each week's gathering of eggs at time of collection, but if this is not possible, do not hold them over 2 weeks

Hatching Quail Eggs under Hens. Bantam hens or small-sized general-purpose hens can be used for incubating quail eggs. Depending on her size, a hen will cover from 15 to 18 eggs. If necessary, treat the hen for lice by rubbing pinches of sodium fluoride over different parts of the body. A suitable hatching box is shown in Fig. 243. The box is set on the ground. Keep the hen confined to the nest except for a feeding period each morning. If red mites appear in the hatching box, remove the eggs and all nesting material while the hen is feeding and disinfect the hatching box thoroughly with a cresol solution and put in new nesting material.

Hatching Quail in Incubators. Commercial quail raisers use incubators, either of the still-air or agitated-air type. Small electric incubators are often used for hatching relatively small lots of eggs. Specially constructed egg trays are provided to hold quail eggs. Turn the eggs at least four times daily up to the nineteenth day. During this period, in the still-air-type incubator maintain a dry-bulb temperature of 103°F. and a wet-bulb reading between 89° and 91° and in an agitated-air-type incubator maintain a dry-bulb temperature of 99.5°F. and a wet-bulb temperature between 87° and 88°.

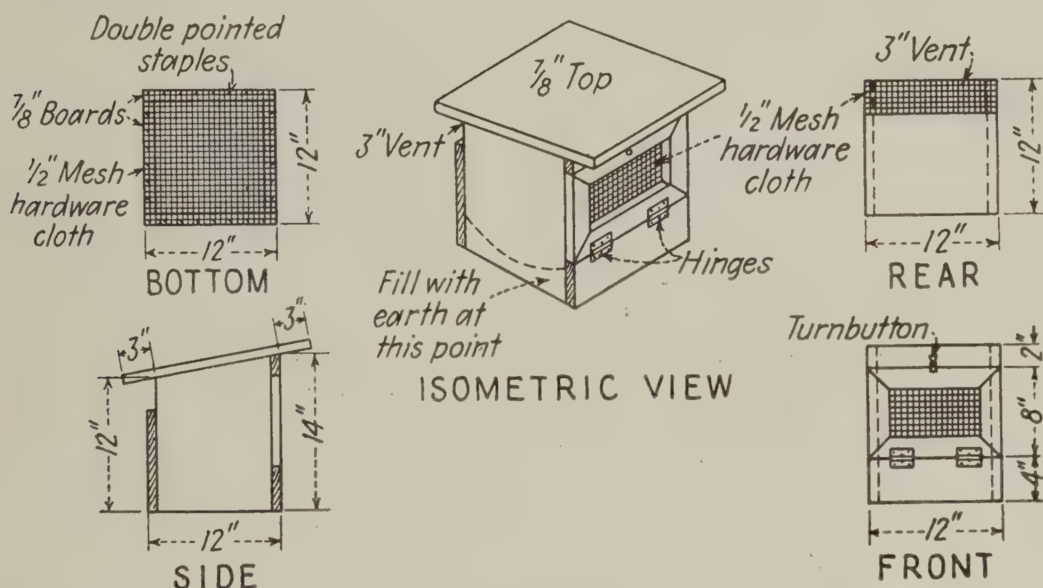


Fig. 243.—Construction details of a hatching box. (*R. B. Nestler and W. W. Bailey, Fish and Wildlife Service, U.S. Department of the Interior.*)

On the twentieth day, change the eggs to the hatching compartment, the hatching trays being carefully covered to prevent the escape of any chicks. During the hatching period, in a still-air-type incubator maintain a dry-bulb temperature between 103° and 103.5°F. and a wet-bulb temperature between 91° and 93°, and in an agitated-air-type incubator maintain a dry-bulb temperature of 99.75°F. and a wet-bulb temperature between 88° and 90°. Keep the ventilators of the incubator wide open. Leave the chicks in the incubator for about 24 hr. after the hatch is completed.

Rearing the Young Stock. Quail chicks can be reared with hens or with brooders of the same type as described previously for brooding turkey poults or pheasant chicks. In most cases, however, mortality is apt to be quite high, often amounting to about 50 per cent. Most of the mortality occurs during the first 4 weeks of the brooding period and is due principally to brooder pneumonia, faulty nutrition, and cannibalism. Corrective measures to prevent losses from these three factors are discussed later.

Brooding Quail Chicks with Hens. If you have hatched your chicks with hens, they can be used for brooding the chicks. A coop for confining the hen is shown in Fig. 244; which also shows an

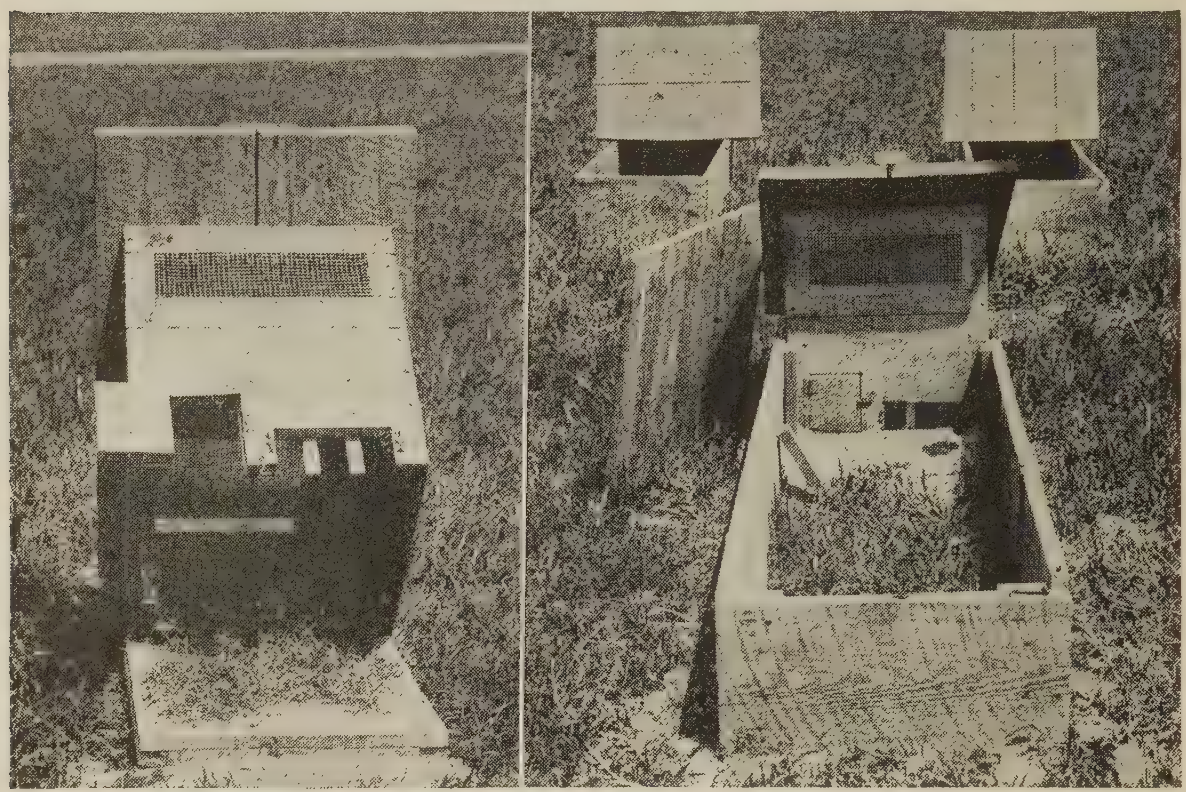


FIG. 244.—Left, brood coop for bantam hen and young quail. Coop is tipped up to show hinged bottom. Right, the coop with attached enclosure for confining the quail chicks for the first several days. (*Virginia Commission of Game and Inland Fisheries.*)

attached enclosure for confining the quail chicks for the first few days. The management of the hen and the chicks is practically the same as for brooding pheasant chicks with hens, discussed previously.

Brooding Quail Chicks Artificially. Quail chicks may be brooded in colony brooding pens with wire-floored runs attached, the pens and runs being placed about 30 in. off the ground, or in colony or continuous brooder houses similar to those used for brooding pheasants and turkeys.

When small numbers of quail are to be raised, the colony brooding pen, such as shown in Fig. 245, is the simplest and most satisfactory method. This brooding pen has a capacity of 40 quail chicks.

The electric heating element for the brooder is placed in the brooding section at one end of the pen. The slope of the roof of the brooding section provides for temperature differences in different parts of the brooding section, so that the quail are able to adapt themselves according to the amount of heat they need. The floor of the pen is made of ⅓-in. hardware cloth and the front end, sides, and top are made of ½-in. mesh wire cloth. Galvanized iron pans are placed under the brooding section and runway to break any draft and to catch the droppings.

Some quail raisers use battery brooders for brooding the quail during the first 3 weeks, transfer them to the colony brooding pen,

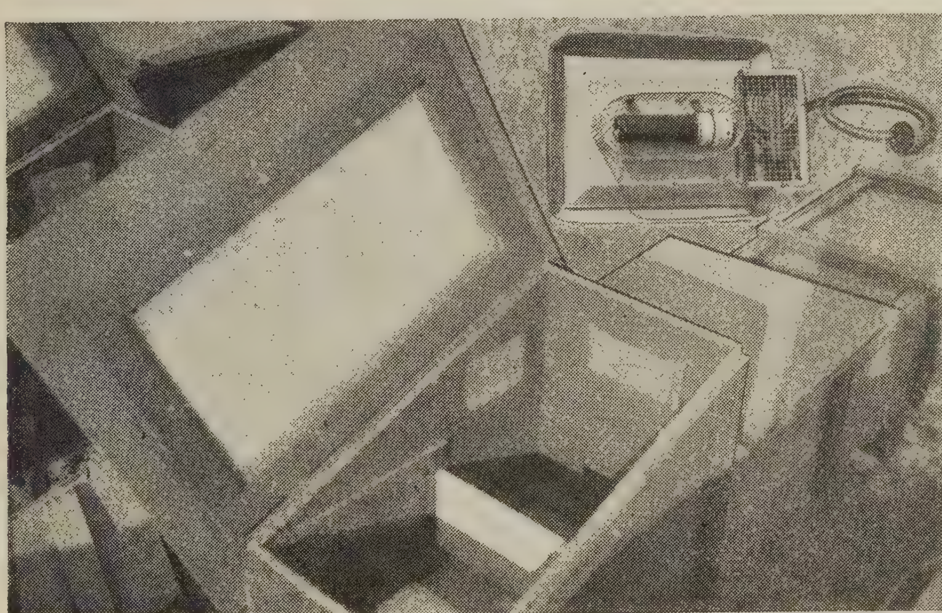


Fig. 245.—Inside view of brooding pen and, in upper right-hand corner, electric unit that is installed in brooding compartment at the left end of the coop. (*R. B. Nestler and W. W. Bailey, Fish and Wildlife Service, U.S. Department of the Interior.*)

where they are kept for 2 weeks, and then transfer them to holding pens. This makes a very satisfactory arrangement.

Many large-scale operators use brooders similar to those used for brooding chickens, turkeys, and pheasants and brood their quail in colony or continuous brooder houses, the continuous house being divided into pens of proper size for a brooder and a brood of chicks. Keeping quail chicks on hardware-cloth floors is more satisfactory than letting them run on the regular floor.

When the chicks are placed under the hover, the temperature should be 95°F. at 1½ in. above the floor. Place a guard around the brooder to keep the quail from wandering away, but move the guard farther away from the brooder each day until the fourth day, when it can be dispensed with. Lower the temperature about $\frac{3}{4}$°F. each day until the temperature is 90°F. on the seventh day. Then lower the temperature 5°F. weekly until about the end of the fifth or sixth week, when quail usually require no more artificial heat. The exact time when heat can be dispensed with depends on the season of the year and the outside temperature.

On the fifth day, if the weather is fine, allow the chicks to run out in the covered runway or sun porch attached to the front of the brooder house. The sun-porch floor may be covered with fine sand, but a hardware-cloth floor is more sanitary. In warm weather, shade

FIG. 246.—Quail holding pens. (*R. B. Nestler and W. W. Bailey, Fish and Wildlife Service, U.S. Department of the Interior.*)

the sun porch by laying a burlap sack over a portion of the top. When heat is no longer necessary, transfer the quail to holding pens, such as shown in Fig. 246.

Preventing Cannibalism. Little quail are restless creatures and within a few days after being placed in the brooding pen or house are very apt to start picking at each other's beaks, toes, wings, and vents. If the vice is not stopped at once, serious losses may result.

Keeping the quail chicks in semidarkness during the brooding period helps to prevent cannibalism from becoming a serious menace. Plenty of floor space and good ventilation will also help. Provide plenty of feeding and watering space. If the trouble develops in your brood, add 2 per cent salt to the diet for several days. If the vice persists, cut off the end of the upper mandible of offenders, using fingernail scissors. This operation may have to be repeated two or three times.

Feeding Breeding and Young Stock. Breeding stock and young stock are fed dry mashes. Several feed companies make a business of manufacturing mashes for game birds, or homemade mashes can be prepared from formulas given here.

A satisfactory diet, containing 26 per cent protein, for breeding stock is given in the following table. Start feeding this mash 1 month before eggs are wanted. Make the change from the maintenance diet, given in Table 83, to the breeding diet by mixing both diets

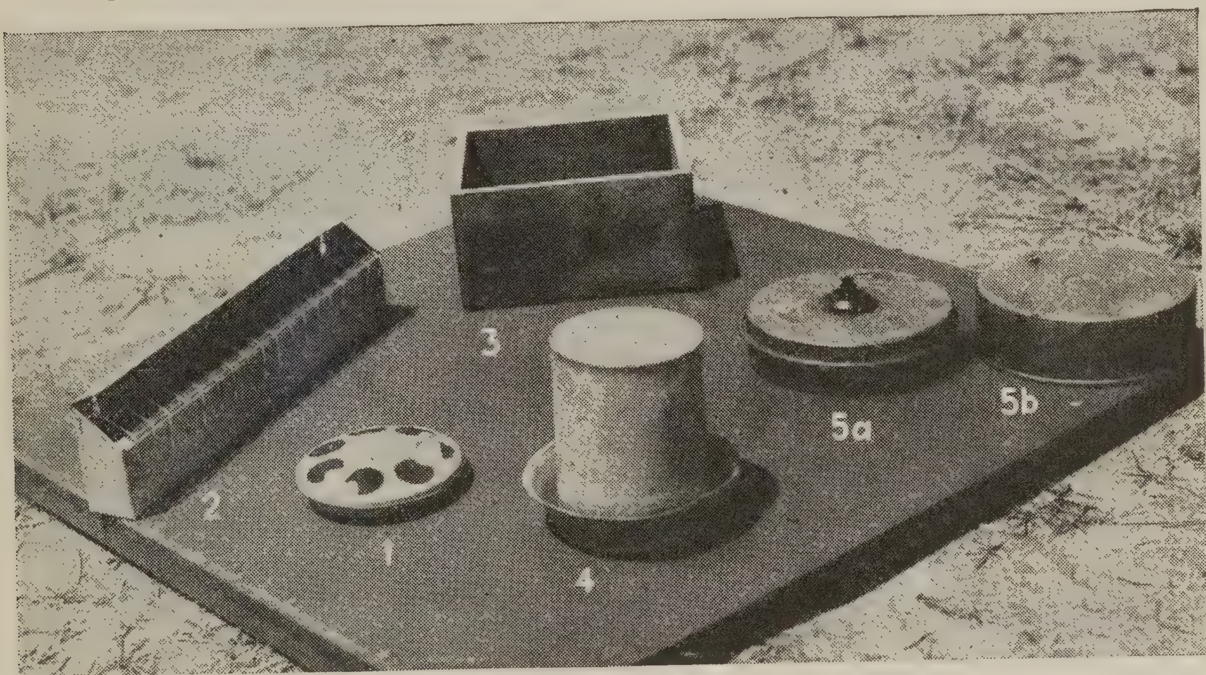


Fig. 247.—Equipment for feeding quail chicks in brooding and holding pens: (1) Chick feeder 6 in. in diameter, with removable top, for grit; (2) wall feeder 2⅛ by 18 by 5 in. high, for mash, with grid to prevent waste; (3) dust box; (4) water fountain, 5 in. in diameter, 2-qt. capacity; (5) kerosene water heater, disassembled to show (*a*) reservoir and wick and (*b*) cover. (*R. B. Nestler and W. W. Bailey, Fish and Wildlife Service, U.S. Department of the Interior.*)

together for 4 or 5 days, gradually increasing the proportion of the breeding diet.

Keep clean water in sanitary containers before the breeders at all times. Clean, sharp-edged quartz or gravel should be provided for grit. Greens in the form of lawn clippings or fresh lettuce may be given once or twice a week to add variety to the diet, although this is really not necessary.

Although quail chicks usually learn to eat and drink quite readily, it pays to spend some time with them the first day or two to teach them how to eat and drink. Sprinkle a few pinches of the mash over the mash in the hopper to attract their attention. Sprinkle a little finely crumbled hard-boiled egg or particles of green leaves on top of the mash. A few particles of green leaves scattered on top of the water in the fountain will encourage the chicks to drink. Too much fiber in the diet for growing quail and coarsely ground yellow corn are objectionable; the diet for young stock given in Table 83 was made up to overcome both objections.

Young quail grow rapidly and need a diet containing approximately 28 per cent protein for about the first 6 weeks. A formula for such a mash for growing quail is given in the accompanying table.

TABLE 83. ALL-MASH DIETS FOR BREEDING STOCK, YOUNG STOCK, AND MAINTENANCE
(R. B. Nestler and W. W. Bailey, Fish and Wildlife Service, 1941)

Ingredient	Parts by weight		
	Breeding stock	Young stock	Maintenance
Yellow corn, ground	25.0	24.0*	85.6
Wheat middlings, standard	10.0		
Millet, ground	.....	10.0	
Alfalfa leaf meal, dehydrated	10.0	5.0	5.0
Soybean oil meal, high-temperature processed	36.0	42.0	7.0
Buttermilk, dried	12.0	16.0	
Bone meal, special steamed	3.0	0.9	1.2
Limestone, high-calcium pulverized	2.5	0.9	
Salt mixture†	1.0	1.0	1.0
Vitamin A‡ and D feeding oil, fortified	0.5	0.3	0.2
Total	100.0	100.1	100.0

* For young quail the yellow corn should be finely ground.

† The salt mixture in the breeding, growing, and maintenance diets given in Table 83 is made up as follows, depending upon whether or not the soils on which crops are grown are deficient in iodine:

Salt Mixture No. 1, without Iodine

	Pounds
Common salt	50.000
Anhydrous manganous sulphate	0.850
Anhydrous ferrous sulphate	0.550
Anhydrous copper sulphate	0.020
Total	51.420

Salt Mixture No. 2, with Iodine

	Pounds
Mixture No. 1	51.420
Potassium iodide	.035
Anhydrous sodium thiosulphate	.032
Calcium carbonate	.035
Total	51.522

These salt mixtures should be prepared for you by a druggist, who is in a position to weigh the different ingredients exactly as indicated.

‡ The following number of international units of vitamin A per pound of feed are required: breeding stock, at least 2,500 during winter and at least 6,000 during the breeding season; growing quail, at least 3,000.

In addition to this mash, keep fresh water in clean containers before the growing birds at all times and provide coarse sand regularly. The growing mash given in Table 83 should be fed in self-feeding hoppers for the first 6 weeks. Freshly cut clover, alfalfa, or lettuce adds variety to the diet. From the seventh week to the thirteenth week give the growing quail a maintenance mash in a separate hopper, the formula of the maintenance mash being given in Table 83. This maintenance diet contains 12 per cent protein, so that when the 28 per cent growing diet is fed along with the maintenance diet, the quail balance their protein intake as they grow older by consuming relatively less and less of the growing diet.

From the thirteenth week onward, the young quail are fed the maintenance diet only. About 1 month before the breeding season,

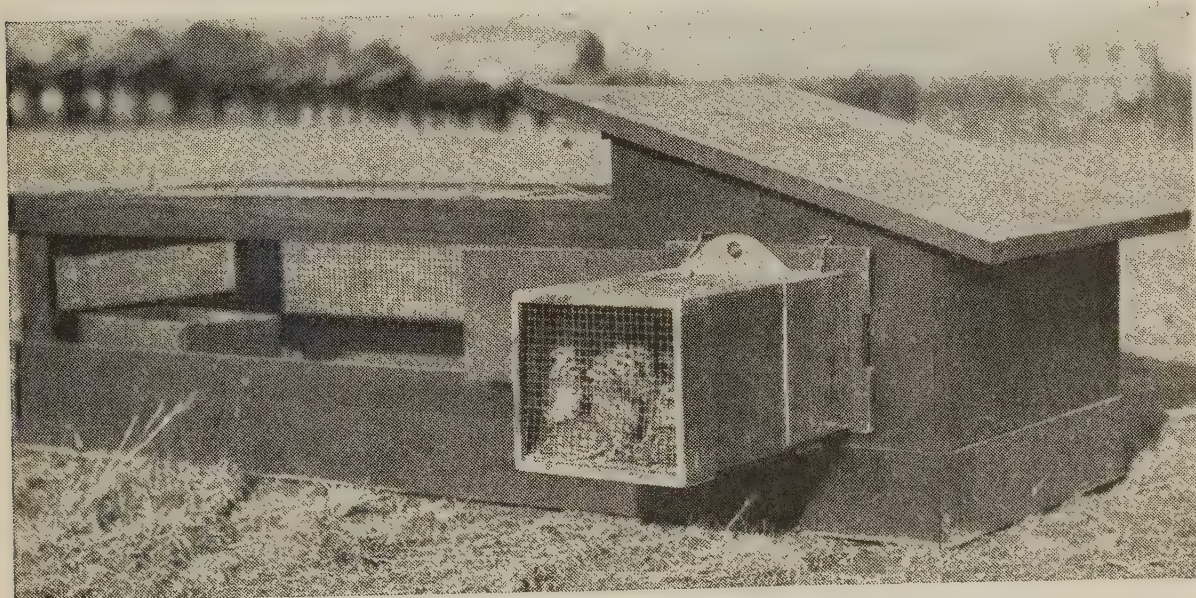


Fig. 248.—Catching box attached to holding pen for catching quail. (*Bureau of Animal Industry, U.S. Department of Agriculture.*)

change from the maintenance to the breeding diet as suggested previously.

Marketing and Liberating Quail. Most artificially propagated quail are raised for stocking purposes, either on the breeder's own premises or for sale to other quail breeders, sportsmen, and state game commissions. *Before offering to sell any quail for food, consult your state game commission*, because some states have rather stringent regulations governing the sale of game birds for food.

Liberating quail is best done in the spring or summer. Select an area that has plenty of undergrowth and an abundant supply of feed available, consisting of seeds, berries, and other vegetation, such as crab grass, ragweed, and lespedeza.

A convenient method of catching quail is shown in Fig. 248, the catching box being attached to one side of the shelter section of the holding pen. Handle the birds carefully. Take them to the area where they are to be liberated and place the crate down on the ground carefully so as not to excite the birds. From two to six pairs of quail could be released at each separate area selected, depending on the number of wild quail already in the area. Before liberating the birds from the crate, sprinkle a little grain at or near the point of release. Open the door of the crate quitely and allow the quail to leave the crate of their own accord. Give them plenty of time. After the birds have been released, sprinkle some grain over the area every day or so to encourage them to remain within the area.

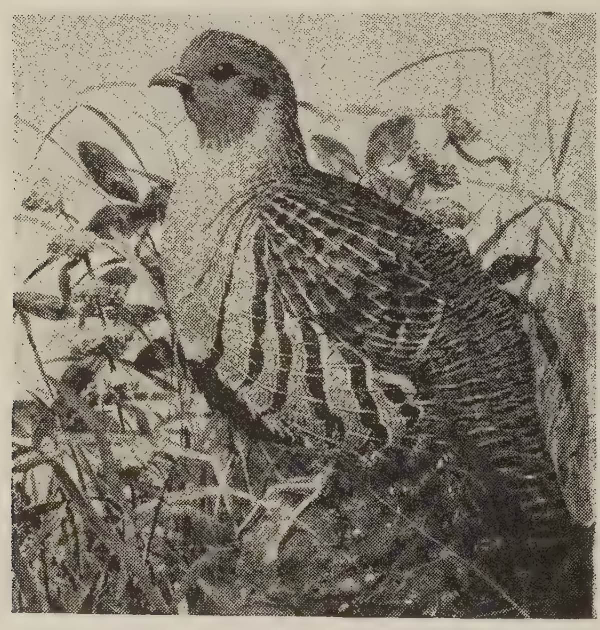


Fig. 249.—Hungarian partridge. (*Fish and Wildlife Service, U.S. Department of the Interior.*)

Constructing wooden shelters within the areas or making suitable shelters out of brush or cornstalks will help a great deal in conserving the quail population over the winter. If natural feedstuffs become scarce due to heavy snowstorms or for other reasons, feed grain regularly until fresh vegetation becomes available in the spring.

3. Raising Partridge

The more important species of partridge in the United States are the Indian chukar partridge and the Hungarian or European partridge. Some of the other species include the Bamboo, Francolin, Himalayan Hill, and Red-crested Wood partridges.

The chukar partridge is a native of India but was imported into this country from China. There are several subspecies, but the one most commonly bred in the United States is quite similar to the French Red-legged partridge. Up to the present the chukar has been bred to a considerable extent in Idaho, Kansas, Montana, Wisconsin, and Washington and increasing numbers are being raised in other states. Adult chukars weigh about 1½ lb., on the average, and in the wild state lay about 12 to 14 yellowish white eggs speckled with brown.

The Hungarian partridge was introduced into this country in the latter part of the eighteenth century. Subsequent importations were made in Virginia, North Carolina, Connecticut, and Pennsylvania, but in many cases the numbers decreased. However, they are well established in such states as Ohio, Wisconsin, Idaho, Oregon, and Washington, as well as in the prairie regions of the Dominion of Canada. The hen lays from 9 to 20 olive-brown eggs, although occasionally a setting may be blue or whitish in color.

They may be propagated artificially in much the same manner as quail, as to both the incubation of the eggs and the rearing of the

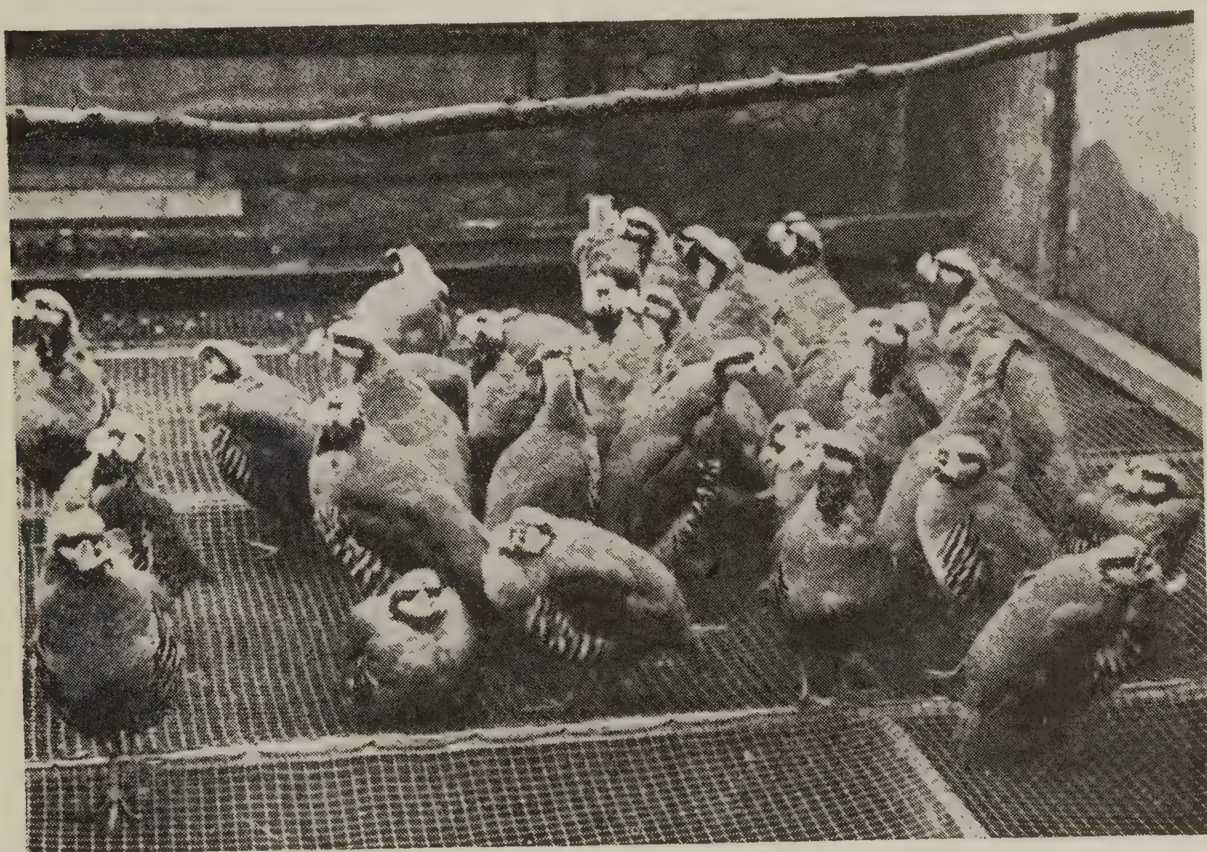


FIG. 250.—Chukar partridge wearing "hen specs" to prevent cannibalism and reared on wire floor to provide sanitation, on Aknusti Game Farm in New York, T. Roe, manager. (*The Beacon Milling Company, Inc.*)

young. Wire floors in the brooding pens are highly desirable to prevent serious loss from disease. Fertility and hatchability are usually much better, however, when the breeding stock is kept on the ground than when it is kept on a wire floor. Artificially lighting the breeders stimulates egg production. Partridge are monogamous in their mating habits, but under domestication one male may be mated to as many as four females. During the mating season some males are apt to scalp the females, so that it is advisable to attach "pick guards" or "hen specs" to the beaks of all males. Artificially propagated partridge are fed practically the same kind of diet as pheasants (see Table 82).

4. Raising Grouse

Of the various species of grouse in this country, the Ruffed grouse is by far the most common. Others include the Dusky, Sooty, Spruce, Franklin's, Richardson's, and Sharp-tailed. The Ruffed grouse is often called "partridge" in New England and "pheasant" in the southern Allegheny states. In a wild state it lays from 7 to 16 eggs, buff or brown in color. An unexplained peculiarity about Ruffed grouse is the fact that in the fall of the year many birds kill themselves by flying against obstacles. In winter, horny projections develop on the toes to serve as snowshoes to support the birds when traveling over the soft snow in dense woods.

FIG. 251.—Prairie Sharp-tailed grouse. (*Fish and Wildlife Service, U.S. Department of the Interior.*)

Ruffed grouse eggs are incubated in the same manner as eggs of the domestic fowl and under proper conditions successful hatches are usually obtained. Rearing grouse chicks artificially, however, is more difficult than rearing most other game birds. Quail-rearing methods described previously are best suited for raising grouse. Artificially propagated grouse become very tame, however, and need to be conditioned before being liberated.

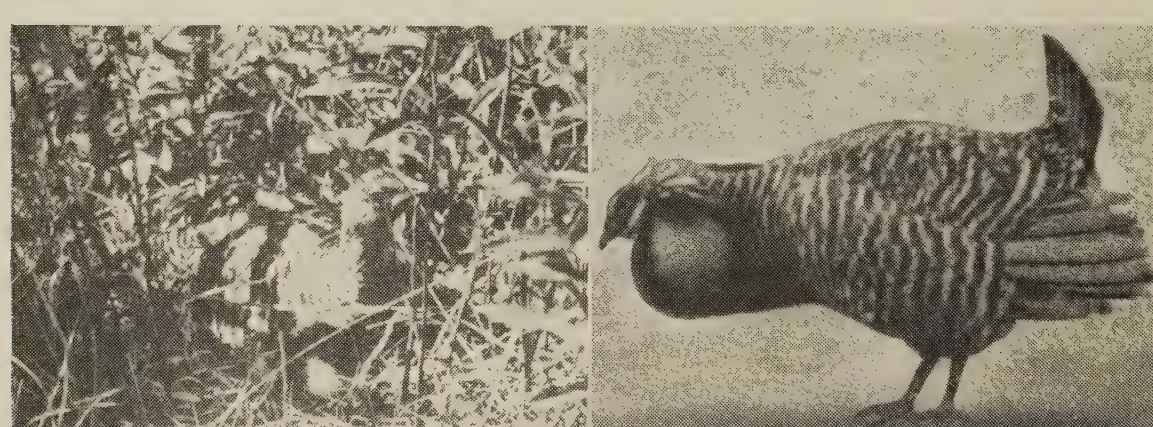


FIG. 252.—Left, female prairie chicken incubating her eggs in a nest partly concealed by a growth of ironweeds. Right, male prairie chicken at the height of the booming performance during the breeding season. (*R. E. Yeatter, Natural History Survey Division, Illinois.*)

5. Raising Prairie Chicken

The true prairie chicken ranges from the Canadian Northwest to eastern Colorado, Arkansas, and Indiana. The eastern race of this species was known as the "heath hen" but was hunted so vigorously that the last survivor disappeared in 1931. Attwater's prairie chicken ranges from Texas to southwestern Louisiana. The lesser prairie chicken once was very numerous in the Middle West but has become greatly reduced in numbers and now ranges mostly from southeastern Colorado and Kansas to central Texas and southwestern New Mexico.

The true prairie chicken weighs about 2 lb., on the average. Artificial propagation has apparently not been attempted, but in some states special measures are taken to increase the numbers in the wild.

6. Raising Wild Turkeys

At the time of the discovery of the New World, wild turkeys were abundant throughout the region between what is now Mexico and

Fig. 253.—Wild turkeys at Washington County Game Refuge, Maryland. (*E. Lee Le Compte, Maryland. Game and Inland Fish Commission.*)

New England. They fell an easy prey to the early colonists, and, as new farming lands were opened up farther and farther westward, the wild stock decreased greatly in numbers. In fact, in many parts of the country, wild turkeys have completely disappeared. Some are still to be found, however, in North Carolina, Virginia, Pennsylvania, and other states. Game laws protect the remaining flocks.

The wild turkey is polygamous, each male usually mating with three or four females. The female selects her nest in a depression in the ground carefully concealed but so located as to allow her to escape readily upon the approach of enemies. About 8 to 16 cream-colored eggs are laid, spotted with lilac and reddish brown, and a day or so after laying the last egg, the female starts to incubate the eggs. The incubation period is 28 days, as in the case of domestic turkeys discussed previously.

Raising Wild Turkeys Artificially. The methods of managing the breeding stock, incubating the eggs, and raising the young in the

Fig. 254.—Wild turkeys on the Game Preserve, Wichita National Forest, Oklahoma. (*R. Rush, U.S. Forest Service.*)

case of wild turkeys are the same as those employed in raising domestic turkeys. In raising wild turkeys for stocking purposes, three precautions should always be taken. Since much crossing often takes place between flocks of wild turkeys and domestic flocks, one should make a special effort to secure native wild stock insofar as possible. Keep artificially propagated wild turkeys completely isolated from domestic flocks in order to preserve the wildness of the former. Although wild turkey poults are best raised in brooder houses, with sun porches attached, to about 8 or 10 weeks of age, they should then be given the liberty of an extensive range with proper protection to prevent losses from storms and predatory animals but left by themselves as much as possible, or they become too tame for releasing. Naturally, every precaution should be taken to avoid exposing the breeding stock and poults to blackhead infection. Wild turkeys are best released at about 16 weeks of age and the best place to release them is near existing wild turkey ranges.

7. Controlling Parasites and Diseases

Upland game birds are attacked by many of the same parasites and diseases that cause heavy mortality in domestic flocks of poultry. As in rearing poultry, sanitation is the best preventive against losses from parasites and diseases. The increased use of hardware-cloth floors for brooding upland game birds is an indication of the importance attached to sanitation by those engaged in the propagation of game birds.

Nevertheless, in most cases where upland game birds are propagated, many unsanitary conditions prevail, with the result that mortality is sometimes excessive. Feeding and watering utensils are allowed to become dirty; the floor of the brooder house is allowed to become damp and dirty; and the land on which game birds are raised is contaminated with the eggs of parasites and the organisms of disease. Any one of these conditions may give rise to the spread of disease and all three combined may cause serious losses.

Carelessness in game-bird management often causes excessive losses. Just a few things need to be mentioned to impress upon everyone interested in the propagation of upland game birds the importance of careful attention to details. Brooding pens are sometimes overcrowded; brooding houses are drafty, causing the birds to become chilled; the fire in the brooder stove is allowed to die out; brooding temperatures are too variable; chicks are neglected when sudden showers come up; chicks are allowed to roam in wet grass; an attendant sometimes goes from a pen of diseased birds to mix feed, the contaminated feed then being taken to pens of healthy birds; pens and houses frequently are neither properly cleaned nor disinfected.

The proper measures for controlling external parasites, such as lice and mites, that affect turkeys were discussed in Chap. 6 and do not need to be repeated here. Several of the diseases affecting upland game birds also affect turkeys, and, since these diseases have already been discussed in Chap. 6, only brief mention need be made of certain upland game-bird diseases that are particularly important.

Pheasants, quail, and other upland game birds often suffer from outbreaks of *coccidiosis* in much the same manner as domestic chickens and poults, although in the case of pheasant and quail the species of coccidia differ from those attacking domestic chickens and poults. *Eimeria phasiani* is responsible for coccidiosis in pheasants and *Eimeria dispersa* is responsible for coccidiosis in quail as well as pheasants. However, the most effective way of controlling coccidiosis in upland game birds is the same as in domestic turkeys, as outlined in Chap. 6.

Pheasants sometimes become infected with the *pullorum* organism, in which case testing to detect reactors should be carried out in the same manner as outlined for turkey breeding stock.

Gapeworms are sometimes a serious menace to pheasants. One of the few practical treatments is as follows: Place infested birds in a covered box with barium antimonyl tartrate in powder form on the floor of the box; run a glass or rubber tube down to the base of the box; during a 10-min. treatment, blow through the tube two to four times to disperse the powder. The coughing which is induced is reported to be quite effective.

Aspergillosis, often called "brooder pneumonia" and "quail rhinitis," is a respiratory disease that is frequently fatal and a serious menace to quail. For a discussion of this disease, see Chap. 6.

If disease breaks out in your flock of pheasants, quail, or other game birds, consult a veterinarian or send some specimens to the pathological laboratory of your state college of agriculture, the address being given in the Appendix. Live sick birds should be taken or shipped to the laboratory for examination. Dead specimens may also be taken, but only birds that have died quite recently and these should be thoroughly cooled before being packed for shipment. There is little use in asking that a diagnosis be made, however, unless complete information is given concerning the nature of the disease outbreak, the relative number of birds affected, and flock management methods employed. The more fully you cooperate with the person conducting the post-mortem examination, the greater are the chances of the investigator determining the cause of the disease. Once the cause has been determined, proper control measures can be taken to reduce further losses. Burn or bury deeply all birds that die on the premises to avoid spreading any disease to healthy birds.

8. Practicing Conservation of Wild Game Birds

The conservation of wild game birds in this country is far more important than most people realize. This is particularly true with respect to the upland game birds previously discussed and certain species of ducks, geese, and swans. The necessity of undertaking definite steps to maintain existing desirable species is obvious when it is recalled that largely through neglect the heath hen and the Passenger pigeon became extinct.

Moreover, the conservation of many species of wildlife is very important because many of these birds are beneficial to agriculture. They destroy enormous numbers of injurious insects and other pests that destroy farm crops. Upland game birds and waterfowl also provide food for human consumption and sportsman's pleasure in hunting. It is plain, therefore, that the conservation of wildlife is sound agricultural practice. In many cases farming practices can be modified so that wildlife is not only preserved but increased and at the same time greater returns secured from the strictly farming operations.

Although under the prevailing laws of the United States, the farmer does not own the game that grows in the wild state on his farm, nevertheless his farming activities affect wildlife propagation,

TABLE 84. KIND OF GROUND COVER NEEDED FOR THE SUCCESSFUL PROPAGATION OF UPLAND GAME BIRDS

(W. B. Grange and W. L. McAtee, Fish and Wildlife Service, 1942)

Species and region	Nesting season	Eggs	Ground cover
Bobwhite quail—east of the Rockies	May–July	9–16	Moderate cultivation, with plenty of woods, thickets, vines, and fruits
Ring-necked pheasant—Northern states	April–July	9–15	Moderate to intensive cultivation; best with near-by marshes or swamps. Under ideal conditions these birds can exist on crop lands alone
Prairie chicken—corn belt and the Southwest	May–July	10–15	Very moderate cultivation. Large areas of marsh or grass, and farm of more than average size required. These birds cannot thrive where farming is intensive
Ruffed grouse—Northern states and Alleghenies	April–May	9–17	Ungrazed mixed woods required; reduction of woods under 15 to 40 acres drives these birds out
Hungarian partridge—northern corn belt and the Northwest	May–July	8–20	Cultivation required, but thickets and other cover are used

and without his cooperation little can be accomplished in preserving and especially increasing the various forms of wildlife. The public hunting grounds that have been established in this country could not accommodate more than a small fraction of the millions of sportsmen who shoot game birds every year. It is in the farmers' interests to cooperate with state game commissions, hunting clubs, and other organizations that foster the propagation of game birds. At the same time, sportsmen should cooperate fully with farmers in assisting them

Fig. 255.—An eroded hillside. The farmer secures practically no returns from such areas on his farm. (*R. B. Nestler, Fish and Wildlife Service, U.S. Department of the Interior.*)

in their propagation enterprises. Mutual understanding between farmer and sportsman concerning the privileges and prerogatives of each will go a long way toward increasing the supply of game birds.

Participating in Upland Game Conservation. The game-bird population of a community is influenced by the kind and amount of ground cover available. Good ground cover is necessary to provide shelter from inclement weather, protection from enemies, and suitable places for nesting. In Table 84 is stated in brief terms the kind of ground cover needed by the different species of upland game birds.

Ground cover consisting of the right kind of vegetation is necessary to provide feedstuffs upon which upland game birds subsist. In many localities, the game-bird population has declined because of an insufficient supply of feedstuffs. A farm that has every acre in cultivation and fields enclosed in wire fences does not attract game birds. In many cases, however, there are sections of the farm, poorly adapted for cultivation and not suitable for grazing, that could be utilized to good advantage for the propagation of wildlife. Eroded hillsides on which are planted trees, shrubs, and other vegetation provide pro-

Fig. 256.—What could be done with the hillside shown in Fig. 255 by making suitable plantings not only to conserve soil but to provide feedstuffs and nesting places for upland game birds. (*R. B. Nestler, Fish and Wildlife Service, U.S. Department of the Interior.*)

tection and nesting places and supply feedstuffs. In addition, further soil erosion and gullying are prevented. Figure 256 shows what might be done to the eroded hillside shown in Fig. 255 to utilize waste farm land for upland game-bird propagation. Evergreens provide excellent cover and make good windbreaks.

The kind of plantings to make are those that will provide feedstuffs consumed by game birds in the wild. For information on the variety of feedstuffs consumed by upland game birds, see Table 85.

There are naturally some differences among the different species of game birds with respect to the particular kind of feedstuffs consumed. For instance, wild turkeys feed almost entirely on seeds, grains, mast, and insects, whereas Ruffed grouse feed almost entirely on browse.

Table 85. Kinds of Feedstuffs Consumed by Upland Game Birds in the Wild
(R. B. Nestler, Fish and Wildlife Service, 1940)

1. *Weed seeds*	With the exception of the Ruffed grouse and the prairie chicken, game birds eat very large quantities of miscellaneous seeds, many of them being from obnoxious weeds. Seeds of beggarweed, bush clover, Japan clover, butterfly pea, ragweed, pigweed, sheep sorrel, partridge pea, foxtail, smartweed, black bindweed, and lamb's-quarters are some of those consumed.
2. *Animal feed*	Grasshoppers, crickets, locusts, weevils, beetles, ants, flies, bees, earthworms, and snails.
3. *Seeds of cultivated plants*	Grains: wheat, barley, oats, buckwheat, benne, corn, kafir, millet, sorghum, rice and rye. Legumes: soybeans and cowpeas.
4. *Mast*	Seeds of the pine, oak, sweet gum, maple, and ash.
5. *Browse* (used especially by grouse).	Leaves of chickweed, field sorrel, Christmas fern, spruce, clover, wood sorrel, hawkweed, and mountain laurel; twigs and buds of maple, mountain ash, hazelnut, apple, cherry, aspen, birch, American hornbeam, and American hop hornbeam.
6. *Fruit*	Blackberry, partridgeberry, smilax, grape, sumac, black cherry, dewberry, and red mulberry.
7. *Mineral*	Limestone pebbles, bits of oystershell, particles of sandstone, and quartz pebbles.

On many farms where game birds are fairly abundant it is often advisable to grow cultivated crops for extra feed supplies. Grow crops that will stand up well when it snows, because it is often difficult for the birds to obtain sufficient feed and many of them starve to death. Good yielding crops for this purpose include corn, flax, millet, sorghum, buckwheat, sunflower, and Sudan grass.

In many parts of the United States winter weather is often very severe and the snow sometimes is quite deep, so that providing shelters of one kind or another and feeding the birds regularly becomes absolutely necessary to avoid severe losses. Build shelters close to good ground cover in areas protected from wind and driving sleet and snow. Leave sufficient openings in each shelter in order that the birds may readily escape if natural enemies approach the shelter.

Shelters make excellent feeding stations. Build the shelters early enough in the fall of the year to allow the birds to become accustomed to the location of the feeding stations before the time of severe weather.

Keep the feed hoppers or containers well supplied with feed throughout the winter. In addition to whatever wild feedstuffs may be available during severe winter months, the following amounts of grain per bird per week should be provided: wild turkeys, 3 lb.; pheasants, 2 lb.; prairie chickens, 1 lb.; partridge, ¾ lb.; quail, ½ lb.

Organizing "Future Farmer" Conservation Projects. During recent years many Future Farmers of America chapters have per-

Fig. 257.—A "teepee" corn shock makes a good shelter and feeding station for upland game birds and helps in reducing loss of life during severe winter weather. (*Staber W. Reese, Wisconsin Conservation Department.*)

formed outstanding service in upland game conservation through organized projects. A few examples of projects carried out are given here to illustrate the variety of work done and to serve as an inspiration to other F.F.A. chapters, which perhaps have not appreciated the importance of game-bird conservation work. It is well to observe at this time that the value of these F.F.A. projects should not be judged exclusively on the basis of the actual service performed by the boys but also from the standpoint of the beneficial effects of improved practices adopted on thousands of farms, thereby enlisting the support of innumerable farmers in upland game-bird conservation.

In Maine the Corinth F.F.A. chapter voted to protect the pheasants in the local community, which had been established there by the state game commission.

In Texas a few years ago, 43 members of the Dublin chapter organized the Dublin F.F.A. Game Preserve; agreements were entered into with 76 farms comprising an area of 13,600 acres, to be protected by 348 game preserve signs. The purpose of the organization was: (1) to control and regulate hunting, (2) bring about a better feeling between farmers and sportsmen, (3) secure and distribute information

FIG. 258.—Shelter and feeding station for upland game birds. The framework of the shelter is supported on two posts set firmly in the ground. The framework is thatched with bundles of millet, buckwheat, and other grains, with heads hanging down. Corn shocks provide additional feed and shelter. Grit is provided. (*F. D. Blair, Supervisor of Game, Minnesota Department of Conservation.*)

on game conservation measures, and (4) make habitat studies of the wildlife in the area.

In one year 14 Missouri F.F.A. chapters fed quail during January, distributing in excess of 3,500 lb. of grain. Five chapters reported feeding 282 coveys. On another occasion Korean Lespedeza was obtained from the Missouri Conservation Commission to produce feed for quail and other wildlife. The seed was to be sown on farms where the owner or tenant agreed to cooperate by permitting the sowing of the seed and where the shooting was not to exceed the estimate of the annual surplus crop.

The Wetumpka F.F.A. chapter in Alabama a few years ago planted 200 lb. of legume seed to provide feed for birds, each member planting ½ acre on his farm.

At its weekly meetings during one season, at least one member of the Hardwick chapter in Vermont was assigned to report on the habits of at least one game animal.

The Covington, Ohio, chapter one year took over the management of a 60-acre game propagation area. The members planted trees, planted an acre of feed-producing crops, built a dam, and put up "no trespassing" signs.

FIG. 259.—The members of the Powhatan, chapter of the Future Farmers of America in Virginia built this quail shelter. Such projects teach members the value of wildlife conservation. (*Powhatan, Chapter F.F.A. Virginia.*)

The members of the Bronson and Willitston F.F.A. chapters in Florida some years ago closed 8,450 acres of land in Levy County for breeding grounds for game birds and other wildlife. The state game commission furnished signs, which the boys posted around the entire reserve, a distance of about 30 miles. The state game commission also furnished native quail, which the boys released in pairs.

In 1940 in Wyoming, Future Farmers who were able to hatch pheasant eggs were supplied with them from the state game farm and the pheasants reared were released on the farms owned by the boys' fathers.

The Virginia Wildlife Federation one year supplied the Troutville F.F.A. chapter with quail eggs and equipment and at 10 weeks of age the birds were inspected by the state game warden. The boys were paid 75 cents for each quail released.

The Holly F.F.A. chapter in Michigan made arrangements one season with the local Sportsman's Club to raise pheasants for release. The eggs ordered were hatched at the state game farm and the chicks were distributed among the boys. Feed was supplied by the Sportsman's Club.

FIG. 260.—Members of the Bronson and Williston, chapters of the Future Farmers of America in Florida, after completing the job of posting signs every 500 ft. on a game breeding reservation, participated in game-bird conservation projects. (*Bronson-Williston Chapters, F.F.A., Florida.*)

A few years ago California's Turlock F.F.A. chapter raised several hundred pheasants hatched from eggs supplied by farmers, who found the eggs in clover and alfalfa fields at cutting time.

One winter, the Scenic City F.F.A. chapter of Iowa Falls, Iowa, established 31 feeding stations for pheasants and prairie chickens. About 50 bu. of grain were fed to the pheasants. During the winter of 1940, the Osceola F.F.A. chapter in Iowa built several shelters of cornstalks for quail and pheasants and fed shelled corn in self-feeding hoppers. Several large coveys were observed.

These citations demonstrate clearly the valuable service rendered by the Future Farmers of America organization in the conservation of upland game birds, especially when it is realized that in the United States as a whole several thousand projects are carried on annually involving artificial propagation of upland game birds and their conservation in the wild.

Improving Farm Wood Lots. Another way in which farmers and Future Farmers can cooperate in the conservation of upland game birds is to make the farm wood lot or other wooded areas more habitable for the birds. In some cases, the farm wood lot is overgrazed with livestock, so that no shelter and nesting places are available for the birds. The right kind of farm wood lot, however, is one in which definite steps are taken to provide for new growth to maintain the supply of wood for the farmer's son and his son, the Future Farmers of tomorrow. As the older trees are cut down, young trees should be coming along. A certain amount of brush should be left to protect the saplings. This underbrush and the vegetation growing within the area provide shelter and nesting places for birds. Thus, the conservation of the wood supply goes along with the conservation of game birds.

In heavily wooded areas, there is often too much underbrush and very little vegetation to attract upland game birds. In such cases, if the trees are too thick some could be cut for wood and some of the underbrush removed and paths cleared. Plantings of shrubs that produce fruits and seeds would serve to attract the birds. In fact, many farmers and Future Farmers would be surprised at the rewards in increased game-bird propagation resulting from a little effort in the wood lot.

Participating in Wild Waterfowl Conservation. There are several species of wild ducks, geese, and swans that provide food and are excellent hunting. The conservation of aquatic game birds includes rearing certain species in captivity and providing adequate refuges for all species. In order to obtain initial stock from the wild, it is necessary to secure a permit from the Fish and Wildlife Service for capturing the birds.

A body of water of some kind, such as a small lake or pond fed by running water, is practically essential for successful results in propagation. Damming a small stream makes a very satisfactory arrangement. There should be a gradual slope around practically all sides of the body of water, and for nesting purposes there should be plenty

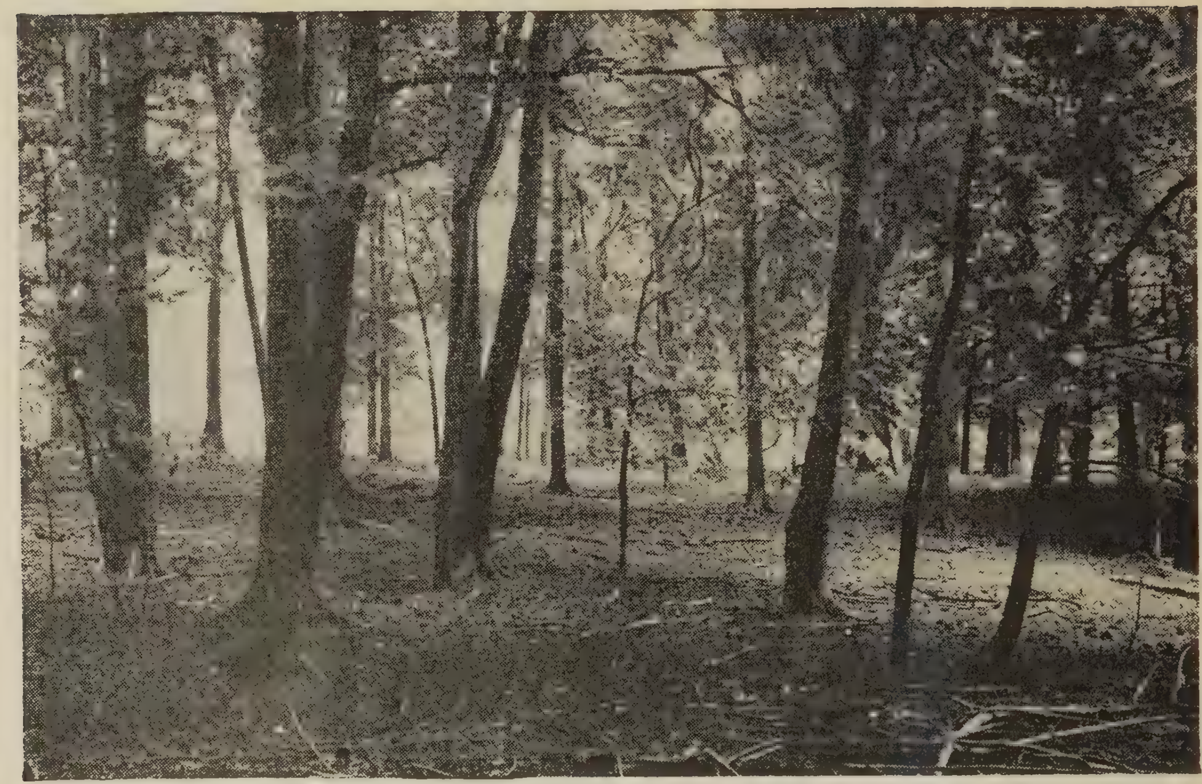


FIG. 261.—The result of heavy grazing of the farm wood lot, unproductive even of forage; devoid of shrub-loving wild creatures; no reproduction of young trees; and mature trees endangered by exposed and trampled roots. Although this illustrates an extreme condition, even moderate grazing is destructive. (*W. B. Grange and W. L. McAtee, Fish and Wildlife Service, U.S. Department of the Interior.*)

FIG. 262.—An ideal farm wood lot (ungrazed), attractive to wildlife and productive of useful forest crops. Compare with Fig. 261. (*W. B. Grange and W. L. McAtee, Fish and Wildlife Service, U.S. Department of the Interior.*)

of natural marshy growth. If there are no natural windbreaks, plant shrubs and evergreens, especially the latter, but do not put them within about 20 ft. of the water's edge. Build a verminproof fence around the entire area and screen it with vines or shrubbery to prevent the birds from being frightened by dogs and other animals.

If a pond is used instead of a stream, be sure the bottom of the pond

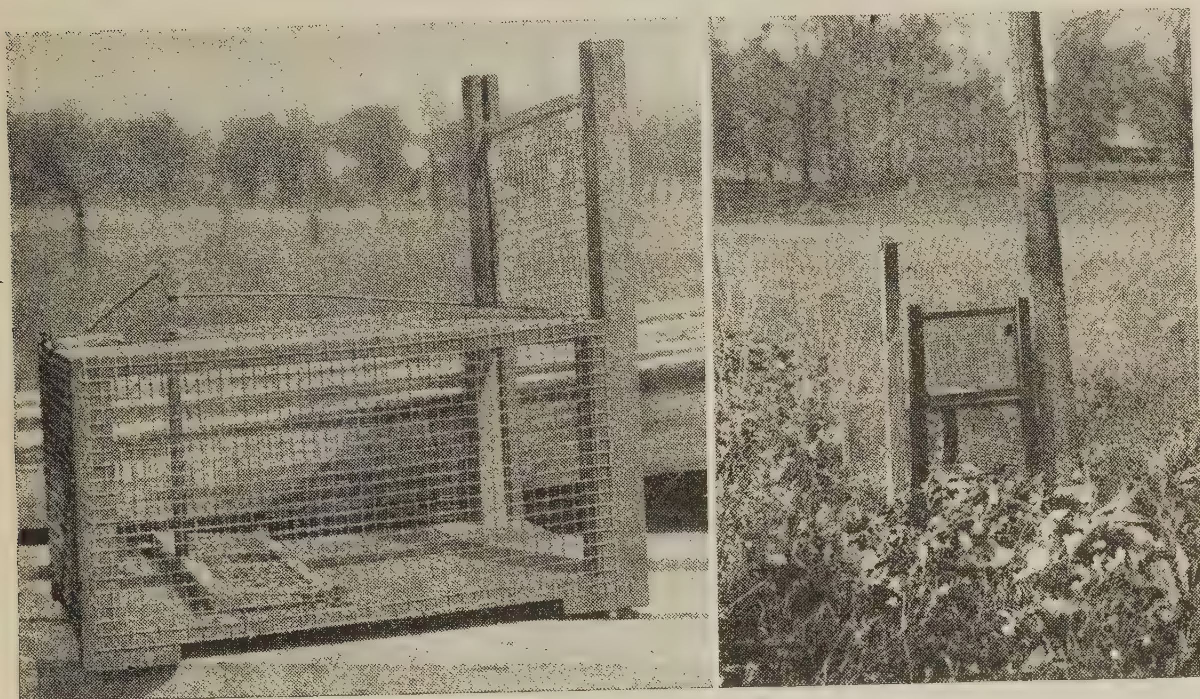


Fig. 263.—Two views of the Evans vermin trap. This trap is 14 in. wide and 24 in. long. The front standards are 27 in. tall and contain a slot ⅜ in. wide and ⅝ in. deep. The door measures 12 by 15 in. Door and treadle (6 in. wide) have the edges soldered in folded strips of heavy zinc. Mesh is ⅝ in. square, heavily galvanized. All screws are brass, the spring phosphorbronze, and the levers iron. Corner posts are tinned inside and the whole triangle of tin on the far standard falls across the slot when the door is down, preventing it from being raised. The illustration at the right shows the location of the trap in a fence corner. (*W. L. McAtee, Fish and Wildlife Service, U.S. Department of the Interior.*)

slopes gently toward the dam or artificial outlet in order that the pond may be drained and thoroughly cleaned from time to time.

In addition to the body of water, a field is necessary for rearing the young birds. A small field or orchard, with a good growth of vegetation and plenty of shade, is suitable and it should be properly fenced. The young birds should be reared in a different field the next year, the field used previously being plowed and sown with a mixture of grass and clover seeds.

Controlling Enemies. Eternal vigilance is necessary to protect aquatic game birds from their numerous enemies, including the great horned owl, hawks, crows, cats, rats, dogs, skunk, weasel, and other mammals. In order to combat the flying enemies mentioned, use the type of jump trap mentioned as a protection for pheasants or, better still, use the basket trap shown in Fig. 225. For trapping mammals, use the Evans trap illustrated in Fig. 263, or a similar kind of trap. The advantages of using this kind of trap over a spring trap are that it is less dangerous to humans and, if harmless animals are caught, they can be released. Predatory animals caught in the trap can be shot while they are still in the trap. Be sure that no snakes, bullfrogs, and snapping turtles are within the area in which game birds are enclosed.

Pinioning Waterfowl. The pinioning of waterfowl is done in the same manner as previously described for upland game birds and illustrated in Fig. 227. Ducks and geese raised in captivity are inclined to return from a flight to the place where they were raised, although they sometimes join wild flocks during the migration season. Swans are quite apt not to return from a flight to the place where they were raised, so that pinioning is a necessity if you want to be sure of keeping them.

Propagating Wild Ducks, Geese, and Swans. Some species can be propagated in captivity without much difficulty, whereas other species present serious problems. One of the greatest obstacles in rearing aquatic game birds in captivity is to secure fertile eggs. Obtain your breeding stock in the fall in order that the birds will become accustomed to their new quarters before the approach of the breeding season. Keep in mind that not all species of aquatic game birds breed the first year in captivity. Their quarters must be large enough to allow them to pair naturally and find suitable cover for their nests. Many species are rather slow to adapt themselves to their new environment.

A house for the breeding stock during the winter months is desirable in all parts of the country and is absolutely essential in sections where winters are severe. The house provides protection from flying enemies and severe storms. Build a shed-roof house enclosed on all sides, with windows or wire-covered openings or both on the south side and ventilators on the north side to provide adequate ventilation in summer. In fact, waterfowl houses need to be well ventilated at all times. The amount of window space or other openings to provide depends upon the section of the country in which you are located and the altitude. If part of the house extends over the water, swimming is usually possible even in the severest kind of weather. A concrete floor is preferable to a board or earth floor because it is ratproof and more sanitary. The part of the floor not covered by water should be kept heavily bedded with dry straw or other litter to avoid frozen feet. Attached to the front of the house or at least a part of the front, build a wired-screened enclosure as a swimming pool. This enclosure is very useful in different ways.

During the breeding season, clip the flight feathers on one wing of each female to prevent her seeking a nesting place outside of the fence surrounding the whole area.

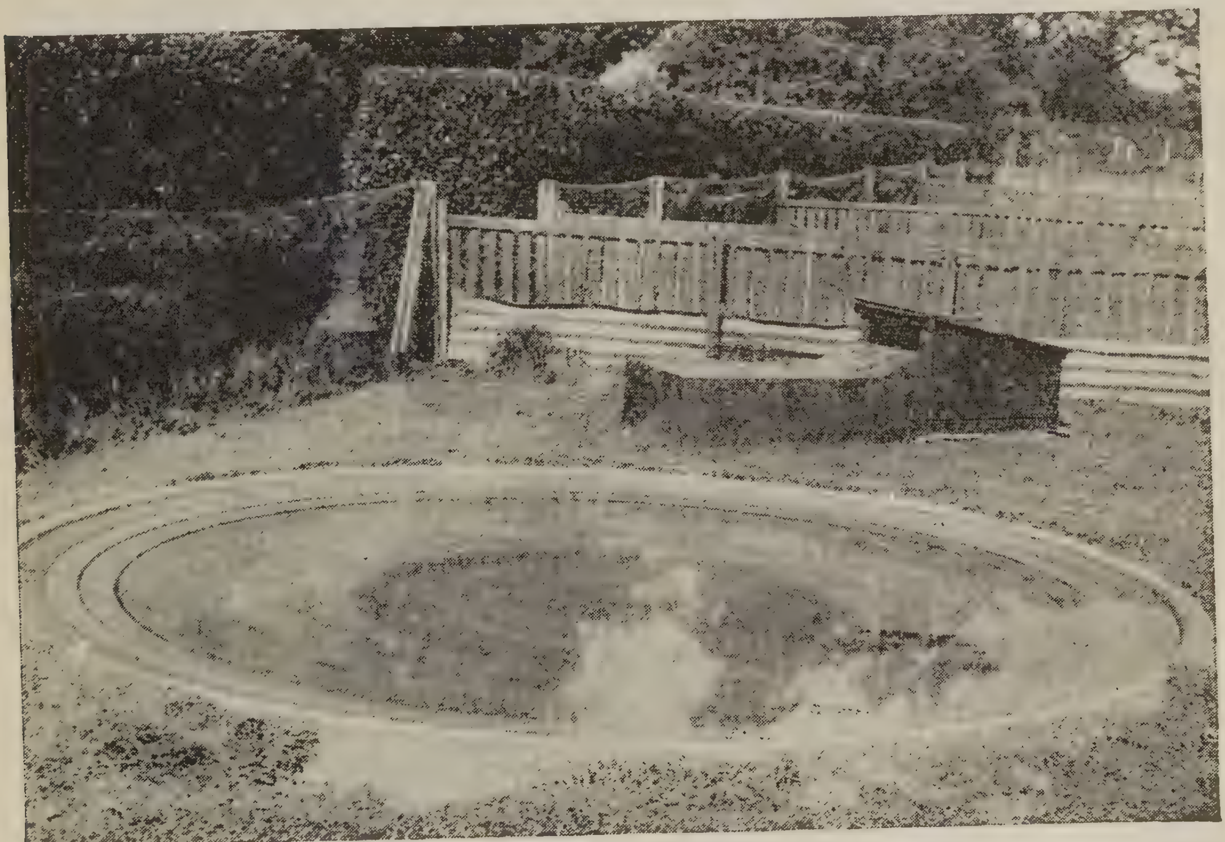


Fig. 264.—Rearing coop and pool for ducklings in a small pen. (*W. L. McAtee, Fish and Wildlife Service, U.S. Department of the Interior.*)

The Mallard duck is readily propagated and is the species of duck most commonly raised in captivity. A mating normally consists of one drake and about five ducks. The ducks usually commence laying in March and lay upward of 40 eggs. The incubation period averages 26 days, with a range from 23 to 29. The incubation period of other wild ducks is teal, 21 to 23 days; black duck, 26 to 28 days; pintail, 22 to 23 days; redhead, 22 to 24 days; and canvasback, 28 days.

Among the different species of geese, the Canada goose has been raised in captivity to a greater extent than any of the others. They are monogamous and remain paired for life. They live for many years, sometimes up to 50 or more years, and are better breeders when several years old rather than when young. Other species of geese, although raised in captivity to a very limited extent, are fed during the winter months at waterfowl refuges. Some of these species include the Lesser Canada, Cackling, and White-fronted geese.

Although swans are classed as aquatic game birds, no one is allowed to hunt them at any time. The Whistling swan is far more

Fig. 265.—Wintering house for aquatic game birds, with attached outdoor swimming enclosure. (*W. L. McAtee, Fish and Wildlife Service, U.S. Department of the Interior.*)

numerous than the Trumpeter. In fact, the latter species is so rare that no trapping is permitted in the limited area where a few small flocks still exist, Montana, Alberta, and British Columbia.

The methods of raising wild ducks, geese, and swans in captivity are essentially the same as those employed in raising domestic ducks and geese, described in Chaps. 9 and 10, respectively.

Establishing Refuges for Waterfowl. A very important factor in the conservation of aquatic game birds is the large number of refuges that have been established in all parts of the United States and Canada. Millions of birds are saved every year at these havens where feed is provided. During the migration season wild ducks, geese, and swans visit the refuges and often remain for some time. At the refuges located near cities and towns, the public is afforded an opportunity of studying the birds firsthand. The establishment of more refuges, where the birds are protected from their enemies, would do much to conserve the supply of these valuable aquatic birds.

SUMMARY

1. Important upland game birds, most of which can be successfully propagated artificially include Ring-necked pheasants, quail, partridge, grouse, and wild turkeys.

2. The conservation of game birds in the wild applies not only to these upland game birds but also to the prairie chicken and aquatic game birds, including certain species of wild ducks, geese, and swans. Swans, however, cannot be shot for food.

3. In most states, game-bird breeders are required to take out a license.

4. In many states, it is necessary to secure Federal permits to buy or sell migratory waterfowl.

5. Yearling pheasant hens mated to two- and three-year-old cocks usually give the best results. Select the earliest maturing vigorous hens in September or October before any stock is sold and in November select vigorous males to be kept as breeders.

6. Mate one male pheasant with up to about 12 females.

7. Each breeding pen for pheasants should provide a certain amount of privacy and contain a shelter.

8. Artificial lighting stimulates early egg production in pheasants.

9. Pheasant chicks may be brooded with domestic hens or artificially, including the use of wire floors.

10. The rearing area for pheasants should be protected against predatory animals of all kinds.

11. About 1 month before eggs are wanted, start feeding the pheasant breeding stock a breeding mash such as outlined for quail breeding stock.

12. Feed pheasant chicks diets containing at least 24 per cent protein.

13. Pheasants for stocking purposes are best liberated in the spring or as soon as the snow has disappeared.

14. The Bobwhite quail is the most popular of the various quail species artificially propagated, although on the Pacific Coast the California and Valley quail are raised extensively.

15. Quail are naturally monogamous and, therefore, are usually mated in pairs.

16. Completely enclosed breeding pens are necessary to ensure best results in breeding.

17. Feed quail breeding stock a diet containing approximately 26 per cent protein.

18. Quail chicks can be brooded successfully in electrically heated, wire-floored brooders.

19. Feed growing diets that contain approximately 28 per cent protein for about the first 6 weeks.

20. Change gradually to a maintenance diet containing approximately 12 per cent protein.

21. As with pheasants, quail for stocking purposes are best liberated in the spring or summer.

22. The artificial propagation of partridge and grouse is much the same as for pheasants and quail.

23. Wild turkeys are propagated in the same manner as employed in raising domestic turkeys.

24. The conservation of upland game birds and acquatic game birds in the wild deserves the utmost consideration of farmers and sportsmen.

25. Farming practices for the conservation of upland game birds involve the use of farm land that is normally idle due to soil erosion, overgrazing, or farm wood lots. The utilization of these areas for the propagation of game birds adds to the farm revenue and to sportsmen's pleasure.

26. Farmers should plant crops and shrubs that will provide feedstuffs for upland game birds and provide shelters for winter feeding.

27. Farmers and sportsmen should cooperate in the program of the conservation of upland game birds.

28. Mallard ducks and Canada geese can be successfully propagated artificially.

29. Wherever practicable, refuges should be established for aquatic game birds as a means of conserving wild stocks.

30. Everything possible should be done by farmers and others in cooperation with state and Federal officials and sportsmen throughout the country to increase the numbers of upland and aquatic game birds for the production of food and in the interests of better hunting.

Appendix

Bulletins, circulars, and other information on poultry are available at state agricultural colleges. Poultry producers in a state should write to their state institutions for information that may be available. Because of the costs of printing, most state institutions are rather reluctant to send bulletins and other printed matter in quantity to residents of other states.

UNITED STATES

Alabama: College of Agriculture, Auburn.

Arizona: College of Agriculture, Tucson.

Arkansas: College of Agriculture, Fayetteville.

California: College of Agriculture, Berkeley.

Colorado: College of Agriculture, Fort Collins.

Connecticut: College of Agriculture, Storrs.

Delaware: College of Agriculture, Newark.

Florida: College of Agriculture, Gainesville.

Georgia: College of Agriculture, Athens.

Idaho: College of Agriculture, Moscow.

Illinois: College of Agriculture, Urbana.

Indiana: College of Agriculture, Lafayette.

Iowa: College of Agriculture, Ames.

Kansas: College of Agriculture, Manhattan.

Kentucky: College of Agriculture, Lexington.

Louisiana: College of Agriculture, Baton Rouge.

Maine: College of Agriculture, Orono.

Maryland: College of Agriculture, College Park.

Massachusetts: College of Agriculture, Amherst.

Michigan: College of Agriculture, East Lansing.

Minnesota: College of Agriculture, St. Paul.

Mississippi: College of Agriculture, State College.

Missouri: College of Agriculture, Columbia.

Missouri: Poultry Experiment Station, Mountain Grove.

Montana: College of Agriculture, Bozeman.

Nebraska: College of Agriculture, Lincoln.

Nevada: College of Agriculture, Reno.

New Hampshire: College of Agriculture, Durham.

New Jersey: College of Agriculture, New Brunswick.

New Mexico: College of Agriculture, State College.

New York: College of Agriculture, Ithaca.

North Carolina: College of Agriculture, Raleigh.

North Dakota: College of Agriculture, Fargo.

Ohio: College of Agriculture, Columbus.

Ohio: Experiment Station, Wooster.

Oklahoma: College of Agriculture, Stillwater.

Oregon: College of Agriculture, Corvallis.

Pennsylvania: College of Agriculture, State College.

Rhode Island: College of Agriculture, Kingston.

South Carolina: College of Agriculture, Clemson.

South Dakota: College of Agriculture, Brookings.

Tennessee: College of Agriculture, Knoxville.

Texas. College of Agriculture, College Station.

Utah: College of Agriculture, Logan.

Vermont: College of Agriculture, Burlington.

Virginia: College of Agriculture, Blacksburg.

Washington: College of Agriculture, Pullman.

Washington: Western Washington Experiment Station, Puyallup.

West Virginia: College of Agriculture, Morgantown.

Wisconsin: College of Agriculture, Madison.

Wyoming: College of Agriculture, Laramie.

Canada

Alberta: College of Agriculture, Edmonton.

British Columbia: College of Agriculture, Vancouver.

Manitoba: College of Agriculture, Winnipeg.

Nova Scotia: College of Agriculture, Truro.

Ontario: College of Agriculture, Guelph.

Quebec: Macdonald College.

Saskatchewan: College of Agriculture, Saskatoon.

Dominion Department of Agriculture, Ottawa.

Federal and State Organizations Concerned with Wildlife Protection

Persons interested in the conservation and propagation of game birds may secure information from certain Federal government units and from state game commissions.

U.S. Department of the Interior, Fish and Wildlife Service, Chicago, Ill.
U.S. Department of Agriculture, Washington, D.C.
Alabama: Department of Conservation, Montgomery.
Alaska: Alaska Game Commission, Juneau.
Arizona: Arizona Game and Fish Commission, Phoenix.
Arkansas: Arkansas Game and Fish Commission, Little Rock.
California: Department of Natural Resources, Sacramento.
Colorado: State Game and Fish Commission, Denver.

Connecticut: State Board of Fisheries and Game, Hartford.
Delaware: Board of Game and Fish Commissioners, Dover.
Florida: Game and Fresh Water Commission, Tallahassee.
Georgia: State Game and Fish Commission, Atlanta.
Idaho: Department of Fish and Game, Boise.
Illinois: Department of Conservation, Springfield.
Indiana: Conservation Department, Indianapolis.
Iowa: State Conservation Commission, Des Moines.
Kansas: Forestry, Fish, and Game Commission, Pratt.
Kentucky: Department of Conservation, Frankfort.
Louisiana: Department of Wildlife and Fisheries, New Orleans.
Maine: Department of Inland Fisheries and Game, Augusta.
Maryland: Board of Natural Resources, Annapolis.
Massachusetts: Department of Conservation, Boston.
Michigan: Conservation Commission, Lansing.
Minnesota: Department of Conservation, St. Paul.
Mississippi: State Game and Fish Commission, Jackson.
Missouri: State Conservation Commission, Jefferson City.
Montana: State Fish and Game Commission, Helena.
Nebraska: Game, Forestation, and Parks Commission, Lincoln.
Nevada: State Fish and Game Commission, Reno.
New Hampshire: Fish and Game Department, Concord.
New Jersey: Board of Fish and Game Commissioners, Trenton.
New Mexico: State Game and Fish Commission, Santa Fe.
New York: Conservation Department, Albany.
North Carolina: Department of Conservation and Development, Raleigh.
North Dakota: Game and Fish Department, Bismarck.
Ohio: Department of Agriculture, Columbus.
Oklahoma: State Game and Fish Commission, Oklahoma City.
Oregon: State Game Commission, Portland.
Pennsylvania: Pennsylvania Game Commission, Harrisburg.
Rhode Island: Department of Agriculture and Conservation, Providence.
South Carolina: State Game and Fish Department, Columbia.
South Dakota: Department of Game, Fish, and Parks, Pierre.
Tennessee: Department of Conservation, Nashville.
Texas: Game, Fish, and Oyster Commission, Austin.
Utah: State Fish and Game Commission, Salt Lake City.
Vermont: Department of Natural Resources, Montpelier.
Virginia: Commission of Game and Inland Fisheries, Richmond.
Washington: State Game Commission, Seattle.
West Virginia: Conservation Commission of West Virginia, Charleston.
Wisconsin: Conservation Commission, Madison.
Wyoming: Wyoming Game and Fish Commission, Cheyenne.

Dominion and Provincial Organizations Concerned with Wildlife Protection

Canada: Advisory Board on Wildlife Protection, Ottawa.
Alberta: Department of Lands and Mines, Edmonton.
British Columbia: Game Commission, Vancouver.
New Brunswick: Department of Lands and Mines, Fredericton.
Nova Scotia: Department of Lands and Forests, Halifax.
Ontario: Department of Game and Fisheries, Toronto.
Prince Edward Island: Department of Agriculture, Charlottetown.
Quebec: Department of Game and Fisheries, Quebec.
Saskatchewan: Department of Natural Resources, Regina.

Bulletins and Circulars, U.S. Department of Agriculture

The U.S. Department of Agriculture, Washington, D.C., has available for distribution to the public numerous bulletins and circulars pertaining to turkeys, ducks, geese, and pigeons.

Breeding, Raising, Feeding

The National Turkey Improvement Plan, *U.S. Department of Agriculture. Bureau of Animal Industry.*
Turkey Raising, *U.S. Department of Agriculture. Farmers' Bulletin* 1409.
Duck Raising, *U.S. Department of Agriculture. Farmers' Bulletin* 697.
Goose Raising, *U.S. Department of Agriculture. Farmers' Bulletin* 767.
Squab Raising, *U.S. Department of Agriculture. Farmers' Bulletin* 684.
Homing Pigeons, *U.S. Department of Agriculture. Farmers' Bulletin* 1373.
Artificial Insemination of Chickens and Turkeys, *U.S. Department of Agriculture. Circular* 525.
The Guinea Fowl, *U.S. Department of Agriculture. Farmers' Bulletin* 1391.
Practical Nutritive Requirements of Poultry, *U.S. Department of Agriculture. Yearbook Separate* 1714.
The Breeding of Turkeys and Ducks, *U.S. Department of Agriculture. Yearbook Separate* 1602.

Diseases, Parasites, and Hygiene

Diseases and Parasites of Poultry, *U.S. Department of Agriculture. Farmers' Bulletin* 1652.
Mites and Lice on Poultry, *U.S. Department of Agriculture. Farmers' Bulletin* 801.
Eradicating Tuberculosis from Poultry, *U.S. Department of Agriculture. Agricultural Leaflet* 102.

Disinfection of Incubators and Brooders, Mimeographed, Bureau of Animal Industry, U.S. Department of Agriculture.

Removal of Gapeworms from Poultry, Mimeographed, Bureau of Animal Industry, U.S. Department of Agriculture.

Stopping Feather Picking and Cannibalism, Mimeographed, Bureau of Animal Industry, U.S. Department of Agriculture.

Controlling Gapeworms in Poultry, *U.S. Department of Agriculture. Agricultural Leaflet* 207.

Marketing

Dressing and Packing Turkeys for Market, *U.S. Department of Agriculture. Farmers' Bulletin* 1694.

Grading Dressed Turkeys, *U.S. Department of Agriculture. Farmers' Bulletin* 1815.

Marketing Poultry, *U.S. Department of Agriculture. Farmers' Bulletin* 1377.

The Cold Storage of Eggs and Poultry, *U.S. Department of Agriculture. Circular* 73.

The Wax Method of Plucking Poultry, Mimeographed, Agricultural Marketing Service, U.S. Department of Agriculture.

Bulletins and Circulars, U.S. Department of the Interior

The U.S. Department of the Interior, Fish and Wildlife Service, Chicago, Ill., has available for distribution to the public numerous bulletins and circulars pertaining to game-bird propagation and conservation.

Original and present breeding ranges of certain game birds in the United States, *U.S. Department of the Interior Biol. Surv., Wildlife Leaflet* BS-158.

Fruits attractive to birds. *U.S. Department of Agriculture, Bur. Biol. Surv. Wildlife Res. and Mangt. Leaflets* BS 41 to 50.

Suggested action program for sportsmen's organizations, *U.S. Dept. Int., Bur. Biol. Surv. Wildlife Leaflet* BS-152.

Wildlife in land planning. *U.S. Dept. Int., Bur. Biol. Surv., Wildlife Leaflet* BS-160.

Planting for wildlife management—an outline. *U.S. Dept. Agr., Bur. Biol. Surv. Wildlife Res. and Mangt. Leaflet* BS-107.

Diseases of upland game birds. *U.S. Dept. Int. Fish and Wildlife Serv. Conserv. Bul.* 21.

Bobwhite quail propagation. *U.S. Dept. Int., Fish and Wildlife Serv.* Conserv. Bul. 10.

The chukar and Hungarian partridges in America. *U.S. Dept. Int., Bur. Biol. Surv. Wildlife Leaflet* BS-159.

Improving the Farm Environment for Wildlife, *U.S. Dept. Int., Fish and Wildlife Serv., Conservation Bulletin* 12.

Propagation of Aquatic Game Birds, *U.S. Dept. Int., Fish and Wildlife Serv., Conservation Bulletin* 29.

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